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SANYO

Service Manual

CO_2 Incubator
MCO-20AIC

FILE No.

MCO－20AIC

SM7210110

Effective models

This service manual is effective following models.

Model name	Model code	Voltage and Frequency	
MCO-20AIC	823 277 51	115V	60Hz
	823 277 52	220V	50Hz
	823 277 53	220V	60Hz
	823 277 54	230V	50Hz
	823 277 55	240V	50Hz
	823 277 56	230V	50Hz
	823 277 57	240V	50Hz
	823 277 58	220V	50Hz
	823 277 59	110V	60Hz
	823 277 60		
	823 277 61		
	823 277 62		

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Features

1. PID control with micro-computer.
   This unit has PID control (Proportional Integrate Differential) accurate controls internal temperature, as well as air sensor system monitoring internal temperature.

2. Infrared CO_2 sensor installed.
   Infrared CO_2 sensor is not affected by humidity.

3. UV sterilization system.
   Water and the circulating chamber air in the humidifying pan are sterilized by UV lamp.
   Optional setting of light mode is available.

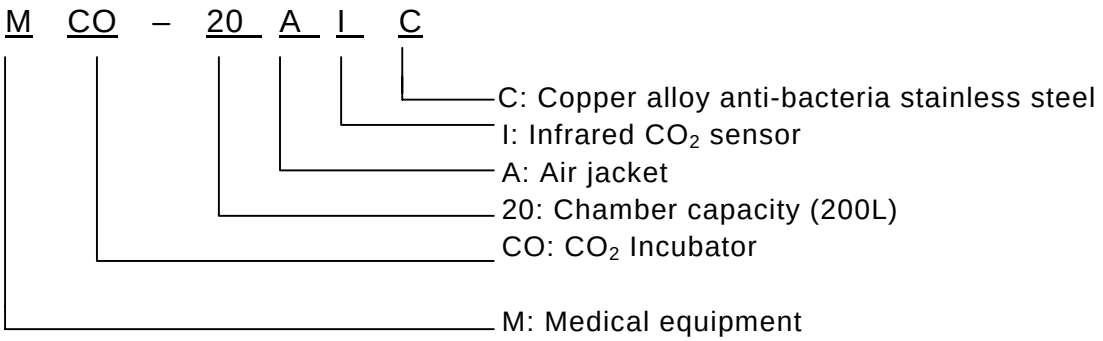
4. Rounded Ball corners.
   Inside chamber wall made by stainless steel and its corner made rounded type.
   This made cleaning easier and de-contamination.

5. Reduce contamination.
   Inside chamber material is made by anti-bacteria SUS.
   Appearance and durability are almost same with ordinary SUS.
   Anti-bacteria SUS has good effect same as copper alloyed. (except for humidity pan)

6. Easy of Use
   Chamber capacity: 195L
   Only 900mm height for double laid.
   'Door mount type' is adopted for control panel. (Large digital display & key pad)
   Selectable left or right door opening. (This service will be available at local)

7. Options
   (1) Castor with adjustor (roller base: MCO-20RB)
   (2) Automatic gas switcher (assembled in unit: MCO-20GC)
   (3) Communication Board (MTR-480)
   (4) Extra stainless steel shelves (1 shelf + 1 shelf support basis :MCO-58ST)
   (5) CO_2 pressure regulator (MCO-100L)

Note ; Model name


M CO – 20 A I C
C: Copper alloy anti-bacteria stainless steel
I: Infrared CO2 sensor
A: Air jacket
20: Chamber capacity (200L)
CO: CO2 Incubator
M: Medical equipment

Structural specification

Product name	CO_2 incubator (air-jacket type)
Model	MCO-20AIC
Outer dimension	(W) 770 × (D) 708 × (H) 900 mm
Inner dimension	(W) 620 × (D) 523 × (H) 665 mm
Capacity	195 liter
Exterior	Zinc galvanized steel with polyester paint (Bio gray)
Interior	Antibacterial stainless steel (containing copper), ball corners
Insulation material	Rigid urethane foam
Door	Polymer alloy (Modified polyvinyl chloride)
Inner door	Tempered glass (thickness 5mm)
Tray	5pcs. (W 580 × D 450 × H 12mm) maximum 15pcs. available. Maximum load 5kg / tray
Access hole	ϕ 30mm × 1, on the rear panel.
Accessories	Shelf support × 5 set, Humidity pan × 1 Stacking plate 1set, Tube fixing × 2, Tube × 1
Weight	106 kg

Antibacterial stainless used parts:

- Inner cabinet
- Tray
- Tray support
- Side support
- Top duct
- Rear duct
- Humidifying pan cover

※The humidity pan is not made of antibacterial stainless.

Performance specification

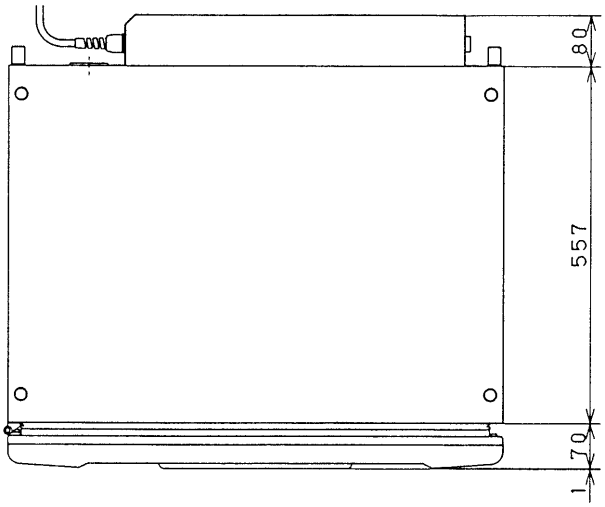
Model name	MCO-20AIC
Ambient Temperature and humidity range	Temperature: 5~35℃ Humidity: less than 80%RH
Temperature control range in the unit	Ambient temperature: 5~50℃ （Setting range: 0~50℃）
Distribution of temperature in the unit	±0.25℃ (SANYO standard)
Variation range of temperature in the unit	±0.1℃
Temperature recovery period	25 minutes recovery to 36.5℃ door open for 30 seconds
CO_2 density range	0~20%
CO_2 density control range	±0.15%
CO_2 density recovery period	10 minutes recovery to 5.0% door open for 30 seconds
Humidity in the unit	95±5%RH
Humidity recovery period	30 minutes recovery to 90%RH door open for 30 seconds
Supply CO_2 gas pressure	0.03MpaG (0.3kgf/c ㎡) Adjust with gas flowing.
Power supply	Single phase, Local voltage
Total power consumption	380W
Quantity of radiation	Max 1370kJ/h

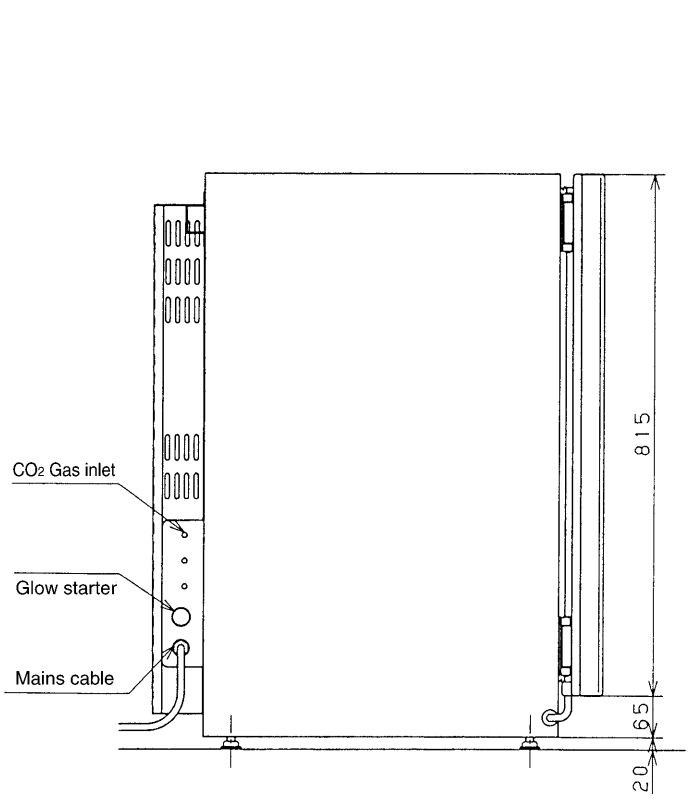
Testing conditions: Temperature in the unit 37℃
CO_2 density set 5.0%
No loading
Ambient temperature 20℃
Ambient humidity about 45%

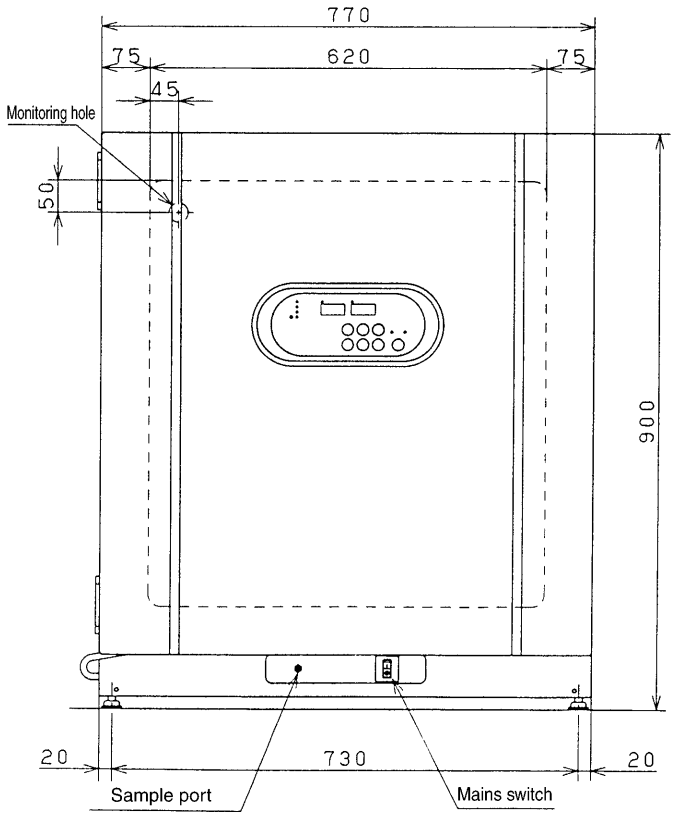
Electrical specification

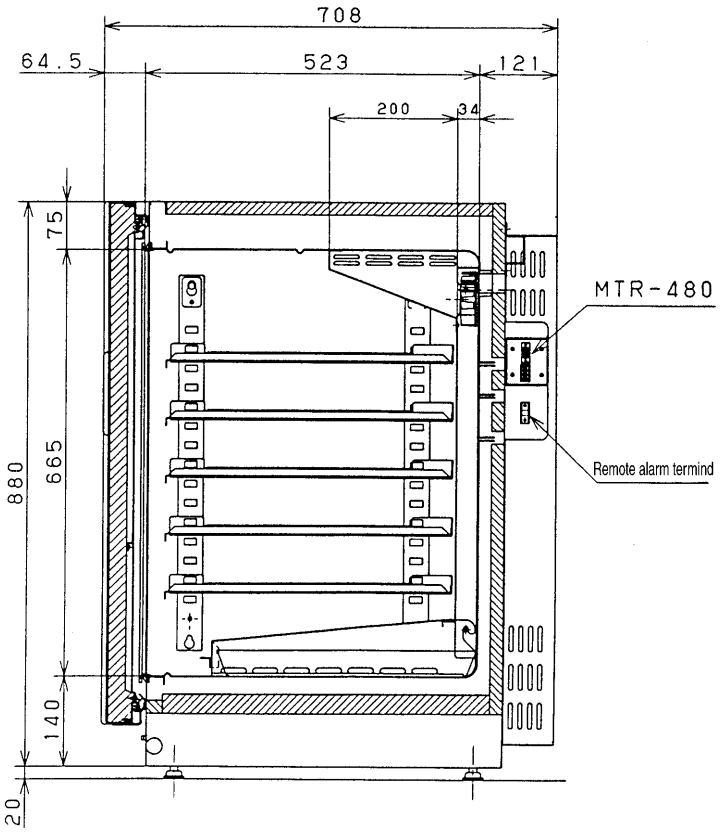
Model	MCO-20AIC
Heating method	Heater jacket ＋ air jacket
Temperature control method	Microprocessor PID Sensor：Thermister sensor（103AT） Detect and control the inside temperature directly.
Temperature indication	Digital display (resolution: 0.1℃)
CO_2 density measuring method	Infrared sensor
CO_2 density indication	Digital display (resolution: 0.1%)
Humidifying method	Natural evaporation by humidifying pan. Humidifying pan (W293 × D407 × H41mm)
UV lamp control	Automatic ON - OFF control (changeable with Function mode) ①Working with door switch (UV lamp turns on for 5minutes after every door close) ②OFF mode (UV lamp does not turn on)
Inside air circulation	Breeze vertical air flow（turbo fan＋fan motor）
Alarm system	Both display for temperature and CO_2 density are flashing, and buzzer sounds intermittently after 15 min. Independent alarm for overheating. Door check lamp.
Over heat protection	Independent thermistor sensor, Electrical independent circuit, Manual setting type, lamp turns on, buzzer sounds continuously, heater is OFF.
Door switch	When outer door is opened: Inside fan OFF : CO_2 valve OFF : Heater OFF (when opening period is longer than 1minute)
Remote alarm	When alarm is activated, remote alarm ON. （Alarm and buzzer are interlocked.） Contact output：rating of contact DC30V 2A
Power source	Local voltage.
Self-diagnosis function	Error code and internal chamber temperature are displayed alternately. Buzzer and remote alarm contact torn on.

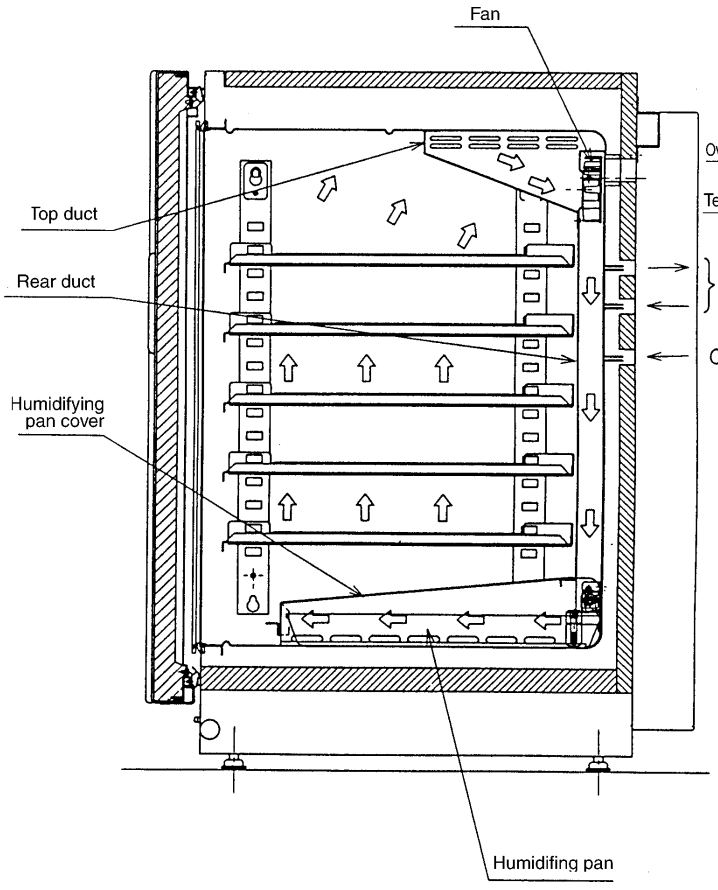
Dimensions

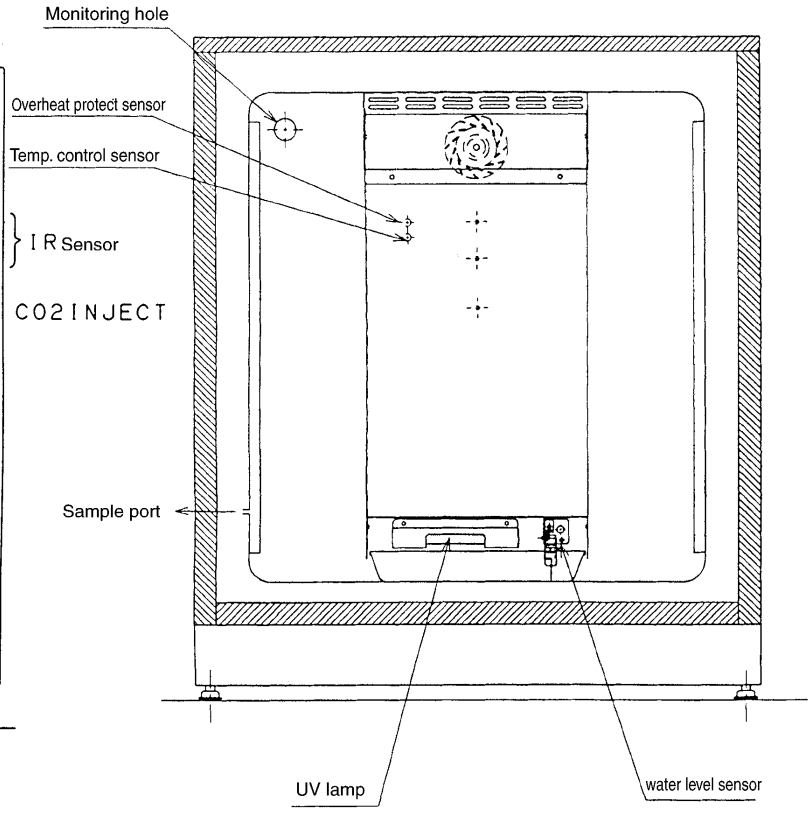

80
557
70
1


CO2 Gas inlet
Glow starter
Mains cable
815
65
20


770
75
620
75
45
Monitoring hole
50
900
20
730
20
Sample port
Mains switch


708
64.5
523
121
200
34
75
880
665
140
20
MTR-480
Remote alarm termind


Fan
Top duct
Rear duct
Humidifying
pan cover
Humidifing pan


Monitoring hole
Overheat protect sensor
Temp. control sensor
I R Sensor
CO2 INJECT
Sample port
UV lamp
water level sensor

Electrical Parts

MCO-20AIC		AC110-115V,60Hz	AC220V,60Hz	AC220V-240V,50Hz
CO_2 Sensor	Type	IR Sensor	IR Sensor	IR Sensor
	Code	MIR-1000CO2	MIR-1000CO2	MIR-1000CO2
Temp. control sensor	Type	103AT-1	103AT-1	103AT-1
	Rating	10KΩ (25℃)	10KΩ (25℃)	10KΩ (25℃)
CO_2 sensor box	Type	103AT-1	103AT-1	103AT-1
Temp. control sensor	Rating	10KΩ (25℃)	10KΩ (25℃)	10KΩ (25℃)
Over heat protect	Type	103AT-1	103AT-1	103AT-1
sensor	Rating	10KΩ (25℃)	10KΩ (25℃)	10KΩ (25℃)
Water sensor	Type	OLS-1003S	OLS-1003S	OLS-1003S
	Rating	DC 5V	DC 5V	DC 5V
Door switch	Type	SS160-A15	SS160-A15	SS160-A15
	Rating	28V 50mA	28V 50mA	28V 50mA
Air pump	Type	AP-1500	AP-1500	AP-1500
	Rating	AC36V	AC36V	AC36V
Auto zero air pump	Type	AP-1500	AP-1500	AP-1500
	Rating	AC36V	AC36V	AC36V
CO_2 solenoid valve	Type	FAB11-X1528	FAB11-X1528	FAB11-X1528
	Rating	DC24V	DC24V	DC24V
UV lamp	Type	GL4	GL4	GL4
	Rating	4W	4W	4W
Glow starter	Type	FG-7P	FG-7P	FG-7P
Ballast	Rating	115V 60Hz 4W	220V 60Hz 4W	230V 60Hz 4W
Noise filter	Type	ZHG2210-11S	ZHG2210-11S	ZHG2210-11S
	Rating	AC 250V 10A	AC 250V 10A	AC 250V 10A
Mains switch	Type	BAM 215131	BAM 215131	BAM 215131
	Rating	250VAC 16A	250VAC 16A	250VAC 16A
DC 5V power supply	Type	WRM05SX-0U	WRM05SX-0U	WRM05SX-0U
	Rating(Primary)	5VDC 3A	5VDC 3A	5VDC 3A
	(Secondary)	85 - 264VAC	85 - 264VAC	85 - 264VAC
Transformer for P.C.B.	Type	ATR-HN231UT	ATR-HN235T	ATR-HN235T
	Primary	110V-120VAC	230VAC	230VAC
	Secondary	8.5VAC, ±18VAC	8.5VAC, ±18VAC	8.5VAC, ±18VAC
P.C.B.	Type	CO-20AIC	CO-20AIC	CO-20AIC

MCO-20AIC		AC110-115V,60Hz	AC220V,60Hz	AC220V-240V,50Hz
Top heater	Rating	115V 14W	230V 14W	230V 14W
		945Ω	3779Ω	3779Ω
Back heater	Rating	115V 26. 1W	230V 26. 1W	230V 26. 1W
		507Ω	2027Ω	2027Ω
Side heater	Rating	115V 30W	230V 30W	230V 30W
(Right & Left)		441Ω	1763Ω	1763Ω
Frange heater	Rating	115V 39W	230V 39W	230V 39W
		339Ω	1356Ω	1356Ω
Bottom side heater	Rating	115V 12W	230V 12W	230V 12W
(Right & Left)		1102Ω	4408Ω	4408Ω
Bottom heater	Rating	115V 40W	230V 40W	230V 40W
		331Ω	1323Ω	1323Ω
CO_2 sensor box heater A	Rating	70. 5V 19. 5W	141V 19. 5W	141V 19. 5W
		254Ω	1014Ω	1014Ω
CO_2 sensor box heater B	Rating	44. 5V 12. 5W	89V 12. 5W	89V 12. 5W
		160Ω	639Ω	639Ω
Hinge sub heater	Rating	36V 0. 3W	36V 0. 3W	36V 0. 3W
(Right & Left)		4410Ω	4410Ω	4410Ω
Front heater	Rating	115V 80W	230V 80W	230V 80W
		165Ω	661Ω	661Ω
Door heater	Rating	115V 80W	230V 80W	230V 80W
		165Ω	661Ω	661Ω
Bimetal thermostat		TH－2	TH－2	TH－2
		60℃:ON／70℃:OFF	60℃:ON／70℃:OFF	60℃:ON／70℃:OFF
Agitating fan motor	Type	FL2－011Y1M	FL2－011Y5M	FL2－011Y5M
	Rating	110－115VAC	220－240VAC	220－240VAC
Thermal fuse	Type	SF70U	SF70U	SF70U
	Rating	250VAC 7A 70℃ OFF	250VAC 7A 70℃ OFF	250VAC 7A 70℃ OFF

Temperature calibration

(note) It is not possible to enter calibration mode with key lock on.

（1） Press [CAL] key for about five seconds.

（2） The top (third) digit of temperature display is blinking, other digits will go off.

（3） Set the present correct temperature with ▶▶ key and ▲▲ key. Press [ENT] key.

（4） The display will automatically revert to the present temperature.

〔Example〕 If the internal temperature display shows 37.0℃（the set value）、the actual measured value is 36.8℃.

① Press [CAL] key for about five seconds.

② The “3” (top digit) of temperature display is blinking, other digits will go off.

③ Set the displayed value at 36.8℃ of the actual measured value with ▶▶ key and ▲▲ key, then press [ENT] key.

④ The display will automatically revert to the present temperature.

（Note）

・In temperature calibration, it is important to accurately measure the internal temperature. Particularly, for the thermometer used, its grade of accuracy should be than JIS 0.5 class. The measure should be carried out at the center of the chamber.

・The temperature calibration range is between the set value ±1.0℃. If the value over this range is input, an error tone will be emitted, the input data will be ignored, and the display will revert to the present temperature. Therefore, if you need to calibrate more than 1.0℃, you should repeat the calibration in several time.

CO_2 Calibration

（1）Press [CAL] key for about five seconds.

（2）The top (third) digit of temperature display is blinking, other digits will go off.

（3）Press [CAL] key again.

（4）The top (third) digit of CO_2 density display is blinking, other digit will go off.

（5）Set the present correct CO_2 density with [▶▶] key and [▲▲] key. Press [ENT] key.

（6）The display will automatically revert to the present temperature.

〔Example〕If the internal CO_2 density display shows 5.0%（the set value）、the actual measured value is 4.5,

① Press [CAL] key for about five seconds.

② The “3” (top digit) of temperature display is blinking, and other digits will go off.

③ Press [CAL] key again.

④ The top (third) digit of CO_2 density display is blinking, other digits will go off.

⑤ Set the displayed value at 4.5% of the actual measured value with [▶▶] key and [▲▲] key, then press [ENT] key.

⑥ The display will automatically revert to the present temperature.

（Note）

- In CO_2 calibration, if CO_2 density display is not more than 2.0%, an error tone will be emitted and the input data will be ignored, and the display will revert to the present temperature.
- CO_2 calibration should be done after CO_2 density measuring was done at least three times. This calibration is available when the CO_2 display is more than 2.0%.
- This unit has auto zero adjustment, make sure CO_2 gas is not full in the place, where incubator is installed.
  Exchange of room air should be done at narrow space.
  (Please request to your customers)

Control specification

1. Key and switch

BZ : When alarm LED is blinking and buzzer does not sound,
Buzzer and remote alarm output ……Force to turn on.
: When alarm LED is blinking and buzzer sounds,
Buzzer and remote alarm output ……Force to turn off.
However, when door alarm is activated, remote alarm remains OFF.

SET : Press once to change to setting mode.
Press twice to change to CO_2 density setting mode.
Press triple to change to check mode of over heat protection temperature,
Press four times to change to internal temperature display mode.

▶▶ : During setting mode, shift between the first digit and second digit and the first decimal place.
In PV display, keep pressing this key over 5 seconds to enter the key lock mode.

▲ : During setting mode, the blinking digit counts up.

ENT : During setting mode, CAL mode and Function mode, press to memory the value.

CAL : In PV display, keep pressing this key over 5 seconds to enter the temperature calibration mode, press again to enter the CO_2 calibration mode.
In temperature calibration mode, input FXX and then press ENT key to enter function mode.

A／B : Available during Auto-changer mode (function mode,F8) is set.
(No response and no light on lamp of cylinder in ordinary use)
When press this key at Auto-changer mode, switch the cylinder in use to another one. Cylinder in current use is indicated by the lamp either A or B which is lighting.
When the cylinder in use is empty, automatically switches to another one. The lamp of empty cylinder will blink and the lamp of another cylinder will turn on. (Ex: When the current CO_2 cylinder A is empty, the lamp of cylinder A lighting switches to blinking, and then the lamp of cylinder B turn on)

2. Temperature control

Setting range : 0℃～+50℃
Display range : 0℃～99.9℃

Setting method : Press the SET key. Change the value to the desired value with ⏫ key and ⏩ key, then press the ENT key. The changed set value will be memorized and change to CO_2 setting mode.

Out of setting range : if the set value is changed out of setting range and pressed the SET key, buzzer will sound one second(continuous sound), set mode remains.

Control : PID control method

Alarm : When the internal temperature is more than ±1℃ of set value,

3. CO_2 Control

Setting range : 0%～20%.
Display range : 0%～99.9%

Setting method : Press SET key twice. Change the value to the desired value with ⏫ key and ⏩ key, then press the ENT key to memorize the set value. Then the display will change to check mode for overheat protection temperature.

Out of setting range : If the SV is changed out of setting range and pressed the ENT key, buzzer will sound one second(continuous sound), CO_2 density set mode remains.

Control : ON-OFF type (when the When set at 0.0%, CO_2 display is disappeared, and then control is also off.

Control OFF : When set at 0.0%, CO_2 display is disappeared, and then control is also off.

Alarm : When the internal CO_2 density deviates from the SV ±1%, the digital display is blinking. After 15 min. later, buzzer will sound intermittently and remote alarm terminal will turn on.

4. Check mode for overheat protection temperature

Setting range : 35℃～51℃

Setting method : Press the SET key triple to display the overheat protection set temperature on the temperature digital display and HI on the CO_2 digital display.
Press SET key again to return PV display mode.

5. Self diagnosis function

When the sensor has any faults and CO_2 tank is empty and so on, error code and PV is displayed alternately. Buzzer will sound and remote alarm terminal will turn on.

【Error code】

E01: CO_2 tank is empty.
E05: Internal temperature control sensor is open circuit.
E06: Internal temperature control sensor is short circuit.
E07: Sensor of CO_2 sensor box is open circuit.
E08: Sensor of CO_2 sensor box is short circuit.
E09: Ambient temperature sensor is open circuit.
E10: Ambient temperature sensor is short circuit.
E11: CO_2 sensor output voltage is abnormal.
E12: Main heater is abnormal.
E13: Bottom heater is abnormal.
E14: Door heater is abnormal.
E15: CO_2 sensor box heater is abnormal.
E16: SSR for each heater is open circuit.
E17: Sample pump and Auto zero pump is abnormal.

Error code details are follows:

E01:CO_2 tank is empty

When internal CO_2 density is not increased to 0.2% for 1 minute with CO_2 valve opened, it displays “E01” alternately with “Internal temperature” at temperature display and buzzer sounds (at intervals). It repeats twice for definite action that CO_2 tank is empty, therefore it takes about 2 minutes to display error after the tank was empty.

E05,06:Internal temperature control sensor is abnormal (open / short circuit)

When internal temperature read by micro-computer is lower than 0℃, it regards as “open circuit”, displaying “E05” alternately with internal temperature and sounding buzzer (at intervals). When internal temperature read by micro-computer is higher than 60℃, it regards as “short circuit” displaying “E06” alternately with internal temperature and buzzer sounds (at intervals). At the same time heater is OFF.

(Remark: At the status of E05 & E06, internal temperature displaying is different from products’ internal temperature.)

E07,08:Sensor of CO_2 sensor box is abnormal (open / short circuit)

Refer to E05,06.

(Remark: At the status of E07 & E08, CO_2 valve is CLOSE.)

E09,10:Ambient temperature sensor is abnormal (open / short circuit)

Refer to E05,06.

E11:CO_2 sensor output voltage is abnormal

It regards CO_2 sensor is abnormal, when temperature of CO_2 sensor box is stable and when internal temperature is not in high/low temperature warning and also when CO_2 sensor output voltage is lower than 1000mV or higher than 4800mV. It displays “E11” alternately with “internal temperature” and sounds buzzer (at intervals). At the same time CO_2 valve is CLOSE.

(For your information, CO_2 sensor output voltage is 863V in the situation of CO_2 density is 0%. The value is applicable only in that temperature of CO_2 sensor box is stable at 45℃.)

E12:Main heater is abnormal

When upper limit temperature alarm is activated or when main heater is open circuit or when main heater SSR is short circuit, it displays “E12” alternately with “internal temperature” and buzzer sounds (at intervals).

Self-diagnosis for SSR and heater failure is done every 40 minutes, therefore error is not displayed just after failed. (For E13～E16, refer to this explanation)

E13:Bottom heater is abnormal

When bottom heater is open circuit or SSR is short circuit, it displays “E13” alternately with “internal temperature” and buzzer sounds (at intervals).

E14:Door heater is abnormal

When door heater is open circuit or SSR is short circuit, it displays “E14” alternately with “internal temperature” and buzzer sounds (at intervals).

E15:CO_2 sensor box heater is abnormal

When CO_2 sensor box heater is open circuit or SSR is short circuit, it displays“E15” alternately with “internal temperature” and sounds buzzer (at intervals).

E16:SSR for each heater is open circuit

When SSR for main heater, bottom heater, door heater and CO_2 sensor box heater is open circuit, it displays “E16” alternately with “internal temperature” and buzzer sounds (at intervals).

E17:Sample pump or Auto zero pump is abnormal

When CO_2 density setting value is more than 3.5% and current density is more than 3.5%, and when voltage difference “during Auto zero” and “before Auto zero” is less than 150mV, it regards that Sample pump and Auto zero pump is abnormal. It displays “E17” alternately with “internal temperature” and buzzer sounds (at intervals). At the same time CO_2 valve is CLOSE. Self-diagnosis is done whenever Auto zero adjustment would be done, however it is ignored at first short intervals of Auto zero.

Alarm for internal temperature is upper limit

When internal temperature is over upper limit, the upper limit temperature alarm lump is turned on and it displays “current internal temperature” alternately with “E12 (main heater is abnormal)” or “E16(SSR for each heaters is open circuit)” and buzzer sounds (at intervals). It is impossible to stop buzzing by key. At the same time main heater, bottom heater and door heater is OFF.

Alarm for internal temperature auto set

When internal temperature is ± 1.0 ℃ out of setting value, all figures of temperature display brink and buzzer sounds after 15 minutes later.

Alarm for CO_2 density auto set

When internal CO_2 density is 1% out of setting value, all figures of CO_2 density display brink and buzzer sounds after 15 minutes later.

6. Key lock function

Lock mode : In PV display, keep pressing ⏫ key (shift key) over 5 seconds to enter the key lock mode, display will change “L 0”.
When pressed ⏫ key and set at 1…Key lock ON,
When pressed ⏫ key and set at 0…Key lock OFF,
Then pressed SET to memorize the setting and return to PV display.

(Note) It can be entered the set mode with key lock on, but other mode can not be entered.

7. Door alarm

Display : When door open……Door check lamp illuminates.
When door is closed…Door check lamp does not light on.

Safety operation : When the door is open, fan motor will turn off, CO_2 valve will be shut off.
If the door is open over 60 minutes continuously, heater will turn off.

8. Auto return

Function : During setting mode, key lock mode and function mode, if there is no key operation over 90 seconds, it will return from setting mode to PV display automatically.

9. Calibration

Refer to page 9 and 10.

10. Function Mode

F00 : The display returns to temperature display. (i.e. EXIT)

F01 : Change the time of turning UV lamp off·····For general users

F02 : Change the setting of UV lamp 24 hours sterilization

F03 : Enter service code (code : 384) ·····Will be used by a service person (This will be the same up to F14)

F04 : Confirm the time of use for UV lamp

F05 : Display the voltage of CO_2 Sensor

F06 : Change the output ratio of bottom heater

F07 : Change the output ratio of door heater

F08 : Change the setting of Auto-Changer, Demo mode, and Auto-zero mode

F09 : Display the temperature of CO_2 sensor box

F12 : Display room temperature sensor temperature

F13 : Initialize non-volatile memory

F14 : Check LED and various driver software

F21 : Set communication device ID

F22 : Set communication parameters

How to use : When the internal chamber temperature is displayed, keep pressing CAL key for more than five seconds, and then you will be in temperature calibration mode. Then, by using ⏫ key and ⏩ key, enter function codes in the temperature display and push ENT key.

F01 : [Purpose] Change the time of turning UV lamp off (Preset time : 5 minutes、Range : 0～30 minutes)

[How to use] Enter "F01" in the temperature display and push ENT key, and then you see the current setting value in the CO_2 display.

By using ⏫ key and ⏩ key, change the setting value and push ENT key. Then the value is recorded, and the display returns to current temperature display.

[Action] UV lamp will be turned off automatically according to the setting time after door closes. Please note that there will be three to five seconds delay, since the sensor checks the water level of humidifying pan upon closing the door. In addition, the UV lamp is off while the door is open.

F02 : [Purpose] Change the setting of UV lamp 24 hours sterilization mode

[How to use] Enter “F02” in the temperature display and push ENT key, and then CO_2 display shows “000”. By using ⏫ key, enter “001” and push ENT key. Then, current temperatures will be displayed and 24 hours sterilization mode will be turned on.

If leaving “000” on, push ENT key. Then, the display will return to the current temperature display mode.

[Action] When “F02” set 24 hours sterilization mode, UV lamp will be turned on for 24 hours ,then off automatically. However, when you open the door, 24 hours sterilization mode will be canceled.

Also, if 24 hours sterilization mode is set with “F02” again while 24 hours mode is already set, 24 hours sterilization mode will begin at the moment.

F03 : [Purpose] Note that those who knows service code should use the functions below.

[How to use]

Enter the following code to use the functions below

（Code：384）

Enter “F03” in the temperature display and push ENT key, and then CO_2 display shows “000.” Next, by using ⏫ key and ⏭ key, enter the service code, “384” and push ENT key. The display will return to current temperature, and you will be able to use the functions following F04.

If you pushed ENT key, for example, to use “F05” without entering the service code above, continuous sound will be going off for one second, and the display will keep showing “F05”. In this case, you can use F05 function by entering the service code above for “F03” function.

Note: It will memorize the service code above, unless you enter “000” for “F03” function or turn off the mains switch.

F04 : [Purpose] Display the time of using UV lamp.

[How to use] Enter "F04" in the temperature display and push ENT key. Then, CO_2 display shows the time of using UV lamp by percentage.

*It considers as 1= 1000 hours for lifetime of UV lamp.

Display shows addition time by percentage up to that time.

<How to add time of using UV lamp>

1) 5 minutes, for setting time of using UV lamp is less than 5 minutes

2) Using minutes, for setting time of using UV lamp is 6～30 minutes

3) 24 hours, for just after pressed ENT "001" at F02 when 24 hours sterilization mode was activated. This additional time is memorized on nonvolatile memory once in 24 hours.

(Remarks) When 24 hours sterilization mode is activated, add 24 hours without considering cancellation of mode that is caused by open door, and so on.

* How to clear addition time is to display addition time at F4, then press ENT by using ⏫ key and ⏩ key to make CO_2 display "000".

* The range of addition time percentage is 0～260%, not displayed when it is more than 260%.

F05 : [Purpose] Display the input voltage (A/D converter input voltage inside the microcomputer on main board) of CO_2 sensor.

[How to use] Enter "F05" in the temperature display and push ENT key, and then CO_2 display shows the input voltage of CO_2 sensor. Pushing ENT key, the Auto-Zero will be forcibly executed within one minute. Since the 90 seconds Auto Return is invalid with this mode, push ENT key and end the mode.

F06 : [Purpose] Adjust humidity level by changing the electricity output ratio at the bottom heater (under humidifying pan).

(Range : 0～19, Initial value : 0)

[How to use] Enter "F06" in the temperature display and push ENT key, and then CO_2 display shows a current temperature. When you want to raise humidity, increase the value in the CO_2 display. When you want to reduce humidity, decrease the value in the CO_2 display. After entering values, pushing ENT key let you return to current temperature display mode.

F07 : [Purpose] ・Prevent dew condensation by changing the electricity output ratio at door heater.
（Range：0～9, Initial value：4）

[How to use] ・Enter “F07” in the temperature display and push ENT key, and then CO_2 display shows current setting values. If the door has dew condensation, increase the value in the CO_2 display. Then, upon pushing ENT key, it memorizes the values and returns to current temperature display mode.

F０８ : [Purpose] ・Change the setting for Auto-zero function, Auto-changer on-and-off function, and demonstration mode.

・**Auto-changer mode** is used when CO_2 needs to be supplied with two CO_2 cylinders. With the “Auto-changer mode”, the lamp of cylinders currently used among A/B lamps at display Board will be turned on, and then you will be able to change the cylinder in use by hand. Also, when the cylinder currently in use is empty, it automatically switches to another cylinder, and the lamp for empty cylinder will blink.

・**The demonstration mode** is a function for exhibitions. With demonstration mode on, it displays the set value of temperature and CO_2, which makes it seemingly stable. In the meantime, the electricity for heater does not conduct, and CO_2 valve is closed.

・**Auto-zero function** is for automatically zero-adjusting CO_2 sensor based on room air. The Auto-zero function is executed every 10 minutes within one hour after turning on power and every four hours afterward.

[How to use] ・Set Auto-changer mode.
Enter “F08” in the temperature display and push ENT key, and then the third figures of CO_2 display shows current setting value. When the value is “0”, normal mode is on (Auto-changer is off). When it is “1”, Auto-changer is on.

・Set demonstration mode.
Enter “F08” in the temperature display and push ENT key, and then the second figures at CO_2 display shows current value. When the

value is “0”, normal mode is on (Auto-zero is on). When it is “1”, demonstration mode is on. When you want to change, change the value at second figure and push ENT key, and then it returns to current temperature display.

・Set Auto-zero mode.

Enter “F08” in the temperature display and push ENT key, and then the first figures at CO_2 display shows current value. When the parameter is “0”, normal mode is on. When it is “1”, Auto-zero mode is off. When you want to change, change the value at first figure and push ENT key, and then it returns to current temperature display.

F09：[Purpose] Display the temperature inside CO_2 sensor box

[How to use] ・Enter “F09” in the temperature display and push ENT key, and then CO_2 display shows the current temperature inside CO_2 sensor box. When you push ENT key or leave it for 90 seconds, it returns to current temperature display mode.

・The preset temperature is 45 ℃. When it fluctuates more than ±2℃ from the preset temperature, CO_2 valve will be closed. When it returns to within ±2℃ from the set temperature, it automatically executes Auto-Zero (adjustment).

・When CO_2 does not inject, the temperature of sensor box may not be within ±2. 0℃, or Auto-zero may be being executed, or it may be within 60 minutes after power is turned on.

F12：[Purpose]Display the temperature of room temperature sensor

[How to use]・Enter “F12” in the temperature display and push ENT key, and then CO_2 display shows the temperature of room temperature sensor. When you push ENT key or leave it for 90 seconds, it returns to current temperature display mode.

Note: The room temperature sensor may not show correct room temperature due to the heat from electrical parts, since it is located on P.C.B ard inside back cover. (It shows about 4℃ higher than actual temperature.)

F13：[Purpose] Initialize nonvolatile memory

This function should be used only when nonvolatile memory data is destroyed and can not be recovered due to unforeseeable reasons such as noises. Therefore, it SHOULD NOT be used without good reasons.

[How to use] Enter “F13” in the temperature display and push ENT key, and then CO_2 display shows “000.” Then, when you change the first figure to “1” and push ENT key, all the data of nonvolatile memory will be initialized.

The initial set values of nonvolatile memory are as follows;

Inside temperature	：37．0℃
CO_2 density	：0．0%
Balance parameter for bottom heater	：0
Balance parameter for door heater	：4
Zero Adjustment data for inside temperature	：0
Zero Adjustment data for CO_2 density	：5000
CO_2 span data	：5000
Key lock data	：Key lock OFF
Auto-changer data	：Auto-change OFF
Demonstration mode data	：Demonstration mode OFF
Auto-Zero	：Auto-Zero ON

F14：[Purpose] Check LED and various driver software.

[How to use] Enter “F14” and push ENT key, and then the lamp and display blink every 0.5 seconds. Push ENT key to finish checking、or, when you leave it for approximately 90 seconds, it automatically stops.

F21：[Purpose] Set ID for serial communication

[How to use] Enter “F21” in the temperature display and push ENT key, and then CO_2 density display shows “000.” Then, entering values to distinguish products (ID for serial communication) and pushing ENT key, you can set serial communication ID.

The range is “000～255 (”000” turns communication off)

F22: [Purpose] Set the mode for serial communication.

[How to use] Enter “F22” in the temperature display and push ENT key, and then CO_2 display shows “000.” Then, changing the third figure, you can change communication modes. “0” is a local mode, and “1” is a remote mode.

Also, changing the second figure, you can change the baud rate. “0” is 2400bps, “1” is 4800bps, and “2” is 9600bps.

Control Mode (third figure)	0: Local (Initial value)
	1: Remote
baud rate (second figure)	0: 2400bps
	1: 4800bps
	2: 9600bps

11. Bottom heater control

In order to shorten the recovery time of humidity, conduct electricity to humidity heater as follows.

- When inside temperature is within −0.4 ~ −0.6 degree from the set temperature, conduct electricity to humidity heater not more than 10 minutes. Except for this case, the set value for "F06" is applied.
- However, you should not conduct electricity continuously for the following cases.
    1). Inside temperature is not yet within −0.2 degree from the set temperature after turning on power.
    2). Inside temperature is not yet within −0.2 degree from the set temperature after continuously opening a door for more than 60 seconds.

12. Door Heater Control

Basically, electricity is conducted the same ratio as main heater, and the electricity conductivity ratio for "F07" is applied in the same way as bottom heater.

However, electricity will be conducted with different rate from main heater for the following cases.

1) Until temperature reaches within −0.2℃ from the set temperature after turning on power

- In order to prevent inside temperature from rising, electricity is conducted with approximately 40% of main heater conductivity ratio.

2) When the set temperature is more than 40℃

- - In order to prevent inside temperature from rising, electricity is conducted with approximately 80% of door heater conductivity ratio.

13. Remote Alarm: Remote Alarm Contact

Normal·····Open

Upon alarm and blackout·····Close

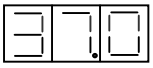
Remote alarm is connected to buzzer sound.

14. Examples for displays

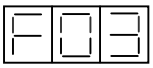
Current Temperature

＋36. 2℃

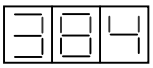
Set Temperature ＋37. 0℃



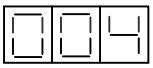
Function F03



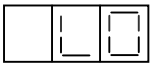
(Service Code Input)



Bottom Heater Ratio 004



Lock Mode L 0

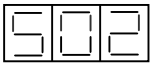


CO_2 Density ＋5. 0%

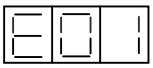
Auto-Zero Adjustment

Decimal point is blinking

CO_2 density Zero Adjustment: 5021



CO_2 Gas Error：E01



15. Humidity pan water level sensor

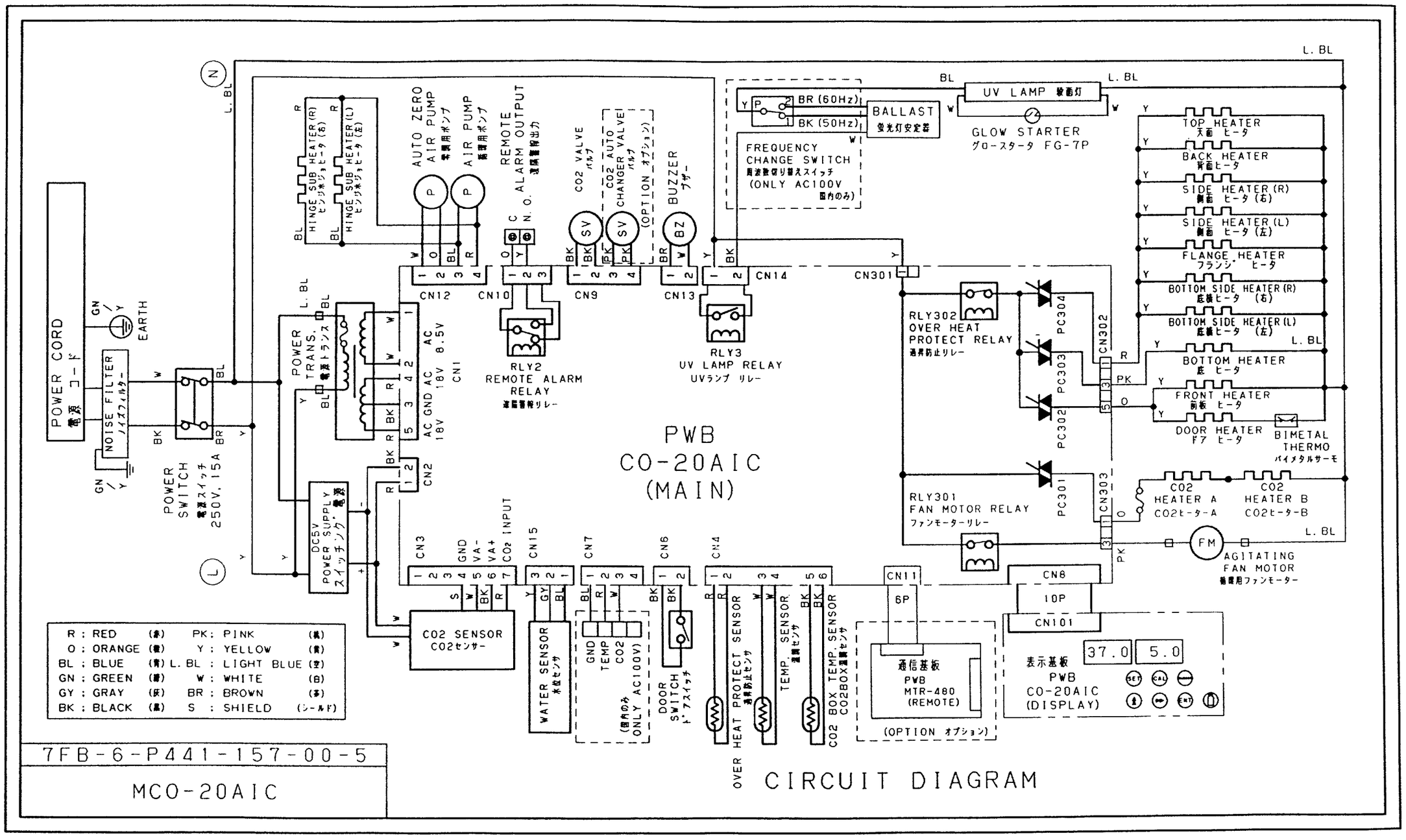
Water level sensor is for checking amount of water in humidity pan.

It checks at start-up, open/close door and every 30 minutes.

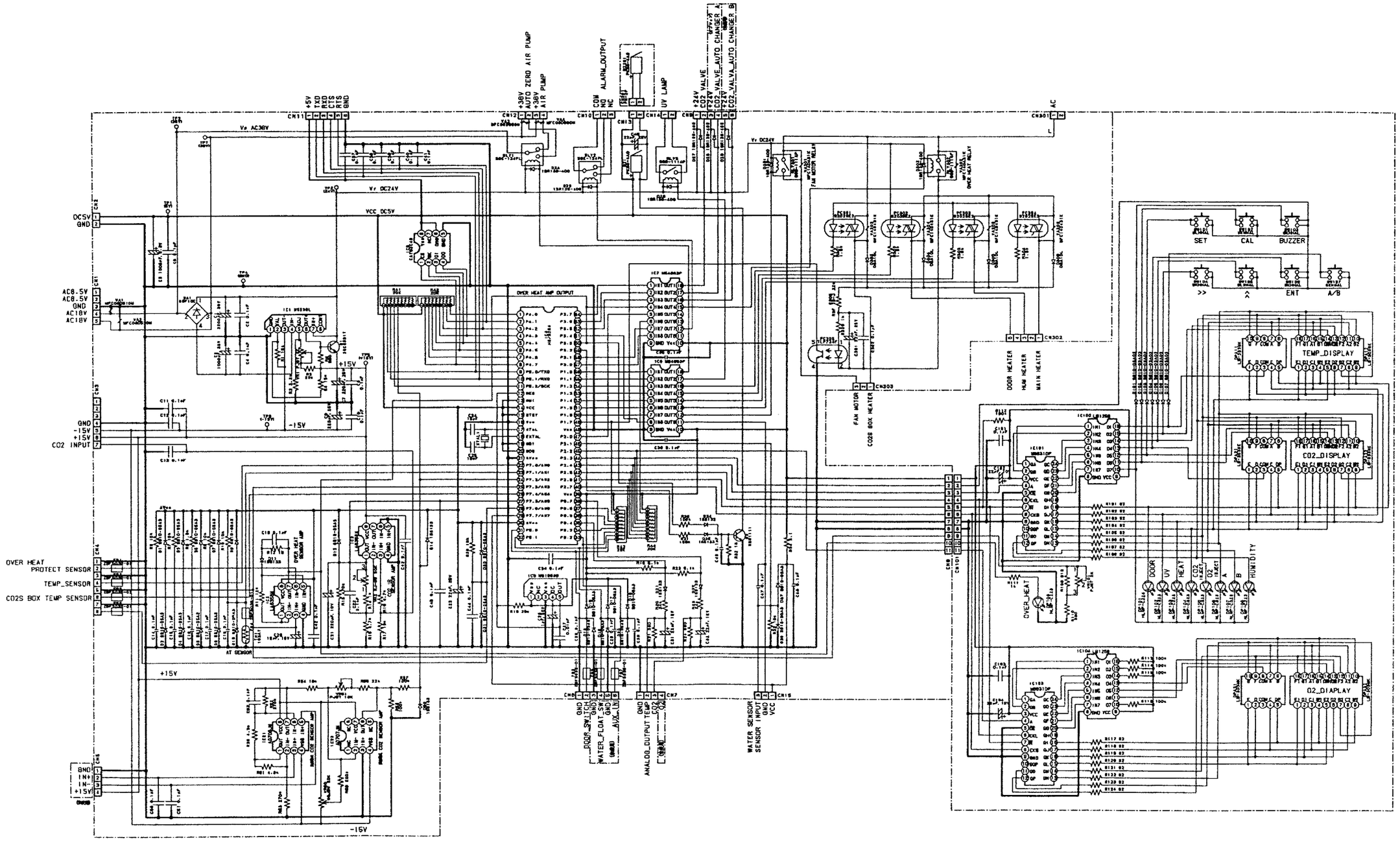
The amount of water : Large ..... Alarm lamp of humidity pan water : OFF

The amount of water : Less than 1L ..... Alarm lamp of humidity pan water : Brink

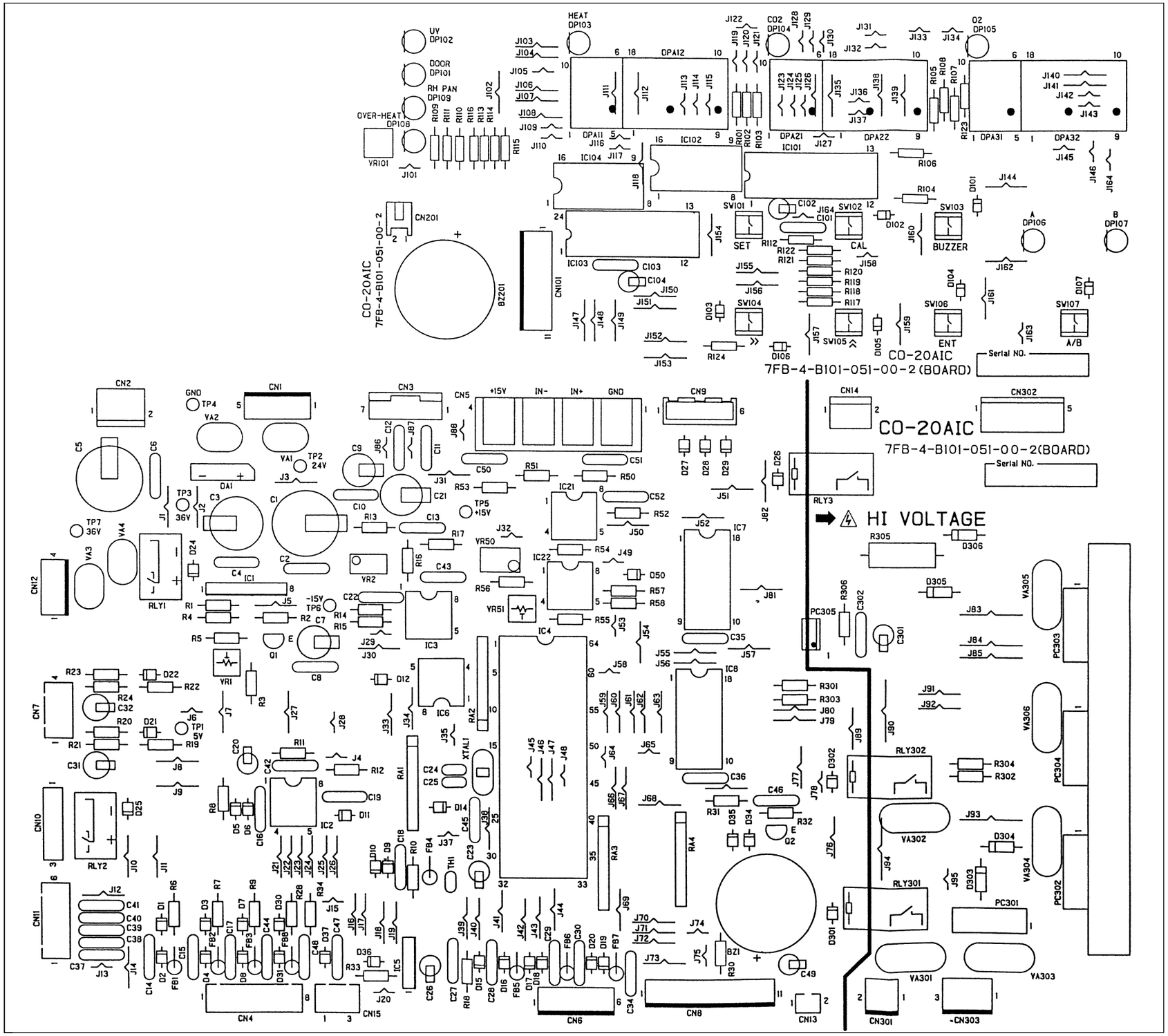
Wiring diagram



Circuit diagram



Silk Print on PCB



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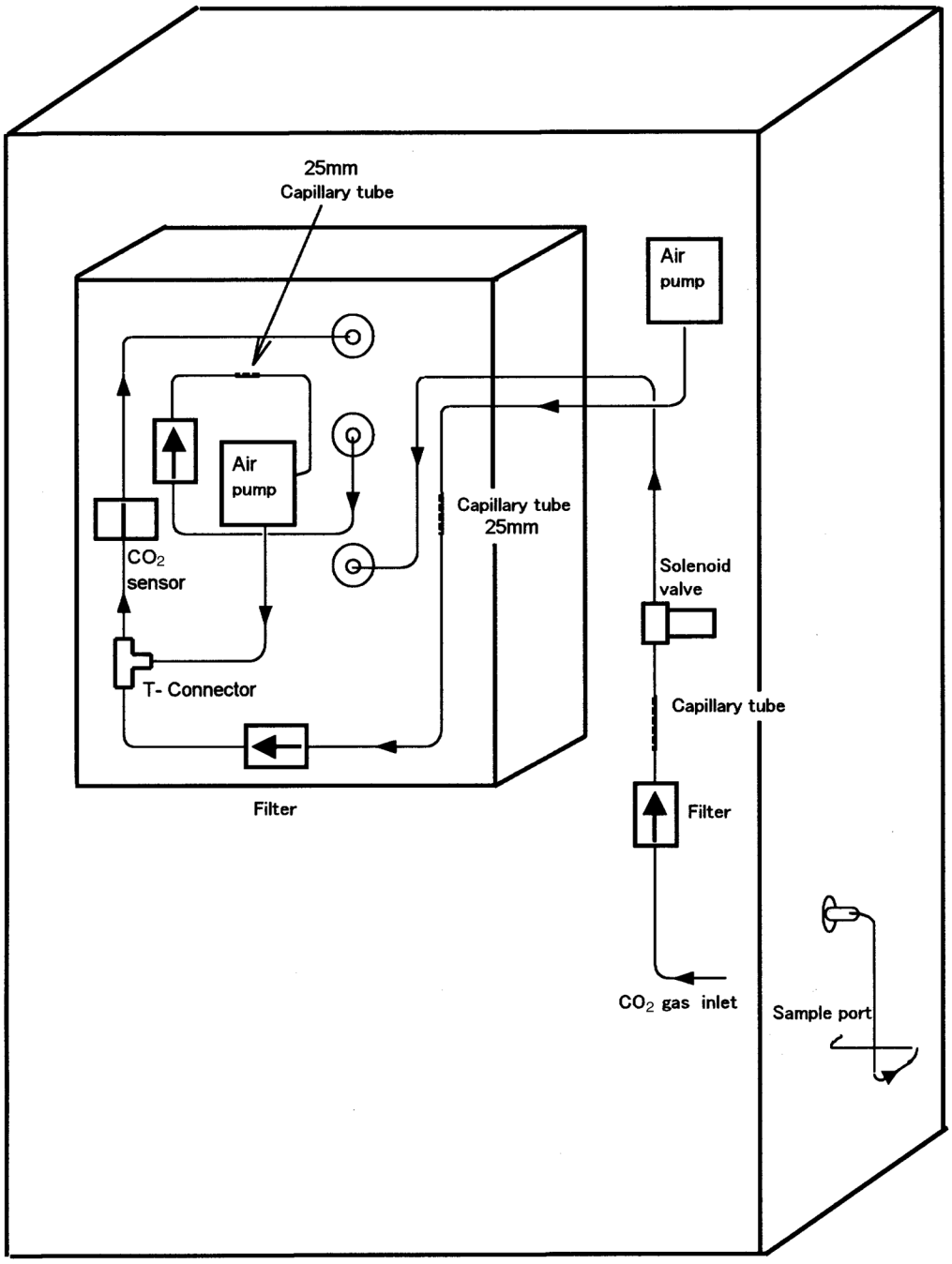
Connection on PCB

The following shows connections of connector(CN) on control PCB.

Connector	Connect to	
CN1	Power transformer for P.C.B #1－#2 AC8.5V #3 GND #4、#5 AC18V	Power supply for PCB Power supply for air pumps (AC36V)
CN2	Switching power supply #1－#2（GND） DC5V	Power supply for PCB and CO_2 sensor
CN3	CO_2sensor	CO_2out put signal
CN4	#1－#2 間 Heat protect sensor #3－#4 間 Temp. control sensor #5－#6 間 sensor box temp. sensor	To detect the temperature
CN6	Door switch	To detect door open / close
CN7	Analogue out put #1－#2 Temp. analogue output #1－#3 CO_2 analogue output	To connect external recorder
CN8	Switch、Display PCB（CN101）	
CN9	#1－#2 CO_2valve #3－#4 CO_2valve（Option）	CO_2 valve ON / OFF control
CN10	Remote alarm terminal #1(C)－#2(N.O)	The terminals make close circuit under the alarm condition
CN11	MTR-480（Option）	
CN12	#1－#2 Auto zero air pump #3－#4 Air pump Hinge sub heater	AC36V output
CN13	Buzzer	
CN14	UV lamp relay (#1-#2 close for UV lamp ON)	UV lamp ON / OFF
CN15	Water level sensor	
CN101	Main control PCB（CN8）	

Connector	Connect to	
CN301	Mains power	
CN302	＃1：Inner chamber heating up（7pcs） ＃3：Bottom heater ＃5：Front heater and Door heater	Heater control
CN303	＃1：Sensor box heater ＃3：Agitating fan motor	Heater and fan motor control

Tubing diagram



Prevention of contamination

In servicing for CO_2 incubator, it is important to prevent from contamination.

(1) More than 90% of contamination in CO_2 incubator is caused by mold. Mold is a kind of true fungi, it has high increasing power under high temperature and high humidity. Accordingly, it is easy for mold to increase inside CO_2 incubator. Those increased mold eat up culture (mainly animal cell), eventually precious test sample will be killed. Cell that is independent from ecosystem is also independent from immune system, it has no immunocompetence at all.

(2) Precautions for mold increasing

There are many cases that mold is increasing by eating fat on the fingers as a source of nutrient in CO_2 incubator.

Therefore,

①Be sure to wash and sterilize your hands prior to servicing. Use 70% ethanol.

②In installing, sterilize the inside wall and shelves after removing shelves, duct, humidifying pan and so on with 70% ethanol.

(3) In the case that mold is already increasing.

Sterilize the interior (walls) and shelves with 70% ethanol after removed all items from the chamber as same as (2)-② above.

And you should sterilize again after 24 hours once sterilized, when the root of spore is geminated, because it is too difficult to remove spore of mold. Repeat sterilization is effective.

NOTICE

In general, stainless steel is known that it is not easy（hard）to rust.

However depends on the conditions, rust might generate.

When you remove rust, we recommend the following agents.

Besides, the surface may become foggy.

Recommended agent:

1. Cream cleanser「Gif」（Unireva）
2. Picasso #SUS300-W（Chemical YAMAMOTO）

＜Picasso has great capability of clean for rust than Gif.＞

Auto zero adjustment

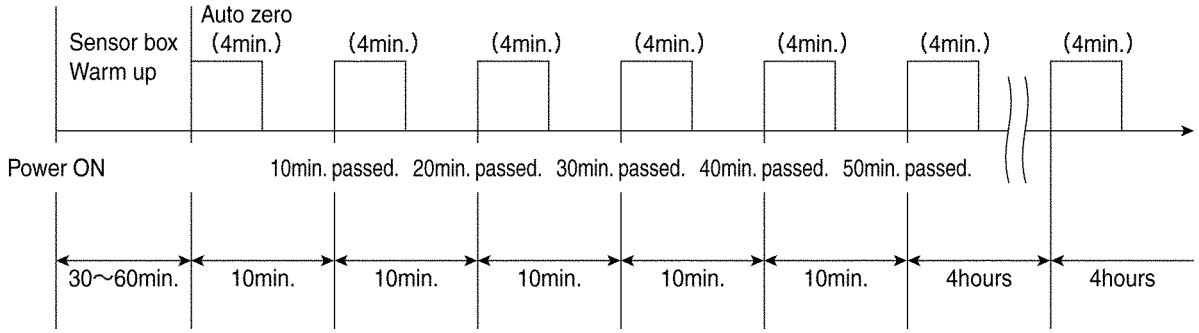
MCO-20AIC uses the infrared CO_2 sensor and it has to be adjusted CO_2 density and output voltage, that they are changing as time goes by. In the first stage (when mains on), auto zero adjustment is carried out every 10 minutes and repeats this cycle six times (total 1 hours), then auto zero adjustment will be carried out every 4 hours. (Refer to the timing chart below).

（1） Mechanism of auto zero adjustment.

○Run the auto zero pump ***for two minutes*** to feed ambient air into CO_2 sensor. During this period, sampling air pump is off. CO_2 density in the atmosphere is almost 0% (0.03%～0.07%), adjust automatically that the measured CO_2 is 0%.

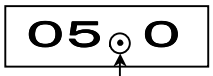
○Then do usual sampling ***for two minutes***, compare CO_2 density of the ambient air with the inside of the chamber. At this time, only air pump for sampling from the chamber is running.

（2） Timing chart of auto zero adjustment



（3） Indication of auto zero adjustment

During auto zero adjustment, indicator of CO_2 density is locked as the density, which is immediate before the auto zero adjustment, is displayed and the decimal point of the indicator is flashing. It is changeable the set value is of CO_2 density during auto zero adjustment.

CO_2 indication 

Flashing

（NOTE） If CO_2 density is set at 0, CO_2 indication shows nothing, so the decimal point also couldn't be seen.

（4） Auto zero adjusting method

Auto zero adjustment is carried out by adding a quarter of difference between each measurement so as not to change the density rapidly.

Ex.） 0.0% ——4 hours——→ 1.0% (CO_2 density) ･･･The added value is 0.25%.

（5） Auto zero adjustment OFF setting

Auto zero adjustment could be set OFF by special function F08.In case that auto zero adjustment does not be set, you should observe CO_2 density that changing as time goes by.

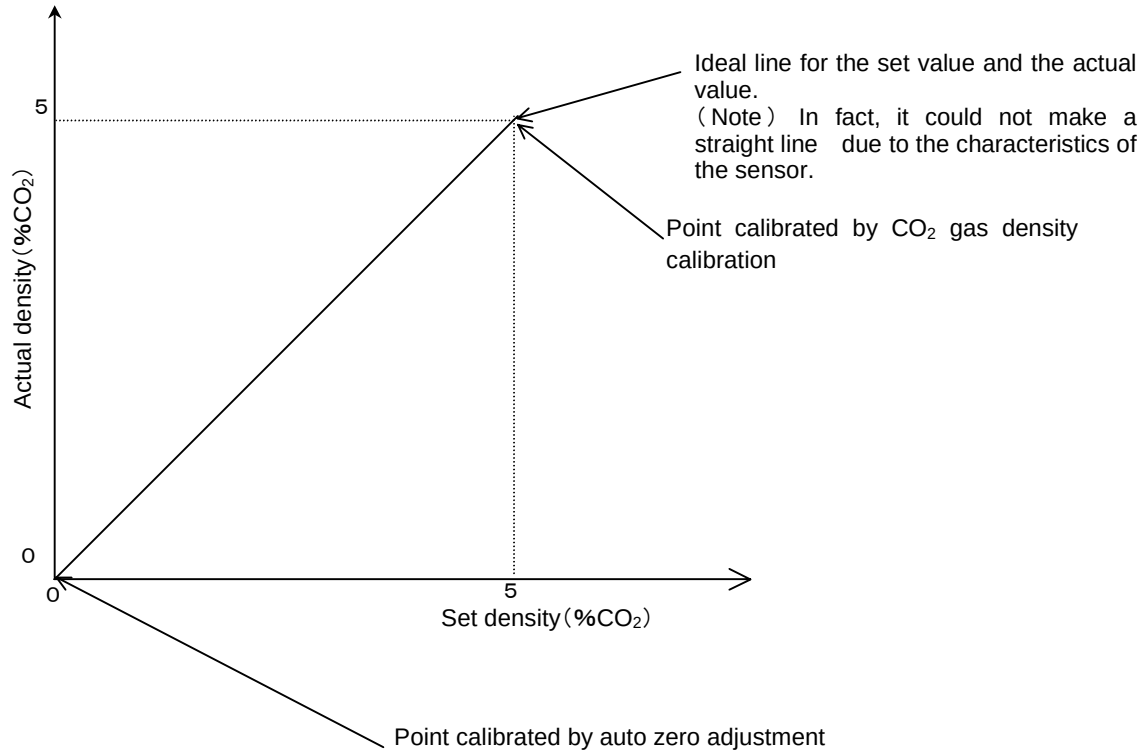
CO_2 gas density calibration and auto zero adjustment

MCO-20AIC has two functions, one is CO_2 gas density calibration by hand, and the other is auto zero adjustment.

1. CO_2 gas density calibration
   When either the internal CO_2 density set value or the display is not match with the actual value, do CO_2 gas density calibration according with "CO_2 calibration" (Page 10) to input the actual value again.

2. Auto zero adjustment
   Refer to "Auto zero adjustment" (Page 33)

3. Relationship to two these functions.
   It could be described as follows.(for example: 5% CO_2)


5
Actual density(%CO2)
0
0
5
Set density(%CO2)
Ideal line for the set value and the actual value.
(Note) In fact, it could not make a straight line due to the characteristics of the sensor.
Point calibrated by CO2 gas density calibration
Point calibrated by auto zero adjustment

Specification of sensor

■ The following shows temperature and resistance characteristics on thermistor sensor 103AT-1.

Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)
0	27.28	17	13.57	34	7.19
1	26.13	18	13.06	35	6.94
2	25.03	19	12.56	36	6.70
3	23.99	20	12.09	37	6.47
4	22.99	21	11.63	38	6.25
5	22.05	22	11.20	39	6.03
6	21.15	23	10.78	40	5.83
7	20.29	24	10.38	41	5.63
8	19.48	25	10.00	42	5.44
9	18.70	26	9.63	43	5.26
10	17.96	27	9.28	44	5.08
11	17.24	28	8.94	45	4.91
12	16.55	29	8.62	46	4.75
13	15.90	30	8.31	47	4.59
14	15.28	31	8.02	48	4.44
15	14.68	32	7.73	49	4.30
16	14.12	33	7.46	50	4.16

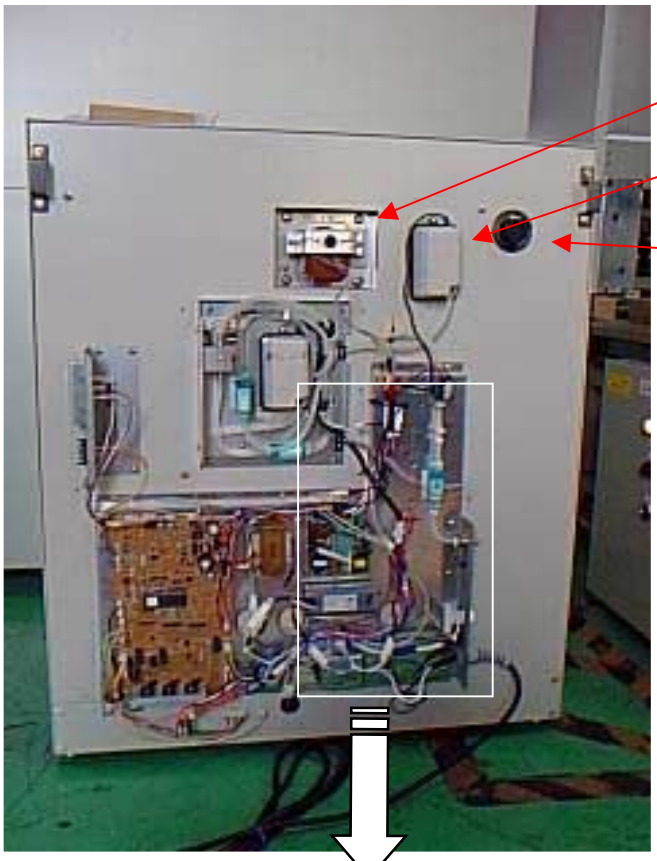
■ The following shows CO_2 density and output voltage characteristics on CO_2 IR sensor. （Output voltage is amplified by amplifier on main PCB.）

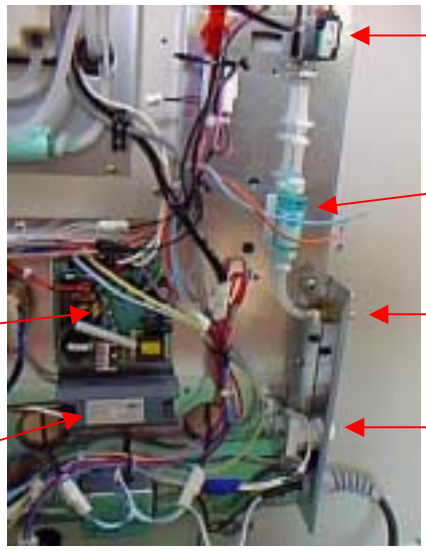
CO_2 density （%）	Output voltage （V）	CO_2 density （%）	Output voltage （V）	CO_2 density （%）	Output voltage （V）
0.0	4.00	8.0	2.87	16.0	2.47
1.0	3.74	9.0	2.80	17.0	2.43
2.0	3.54	10.0	2.75	18.0	2.40
3.0	3.37	11.0	2.69	19.0	2.37
4.0	3.23	12.0	2.64	20.0	2.33
5.0	3.12	13.0	2.59		
6.0	3.02	14.0	2.55		
7.0	2.94	15.0	2.51		

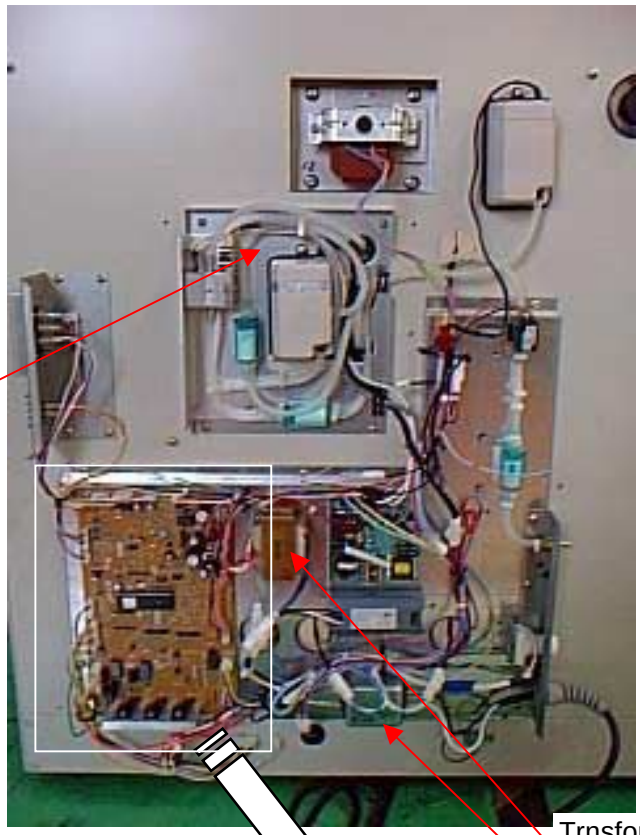
＊ This output voltage figure are used reference only.

＜Memorandum＞

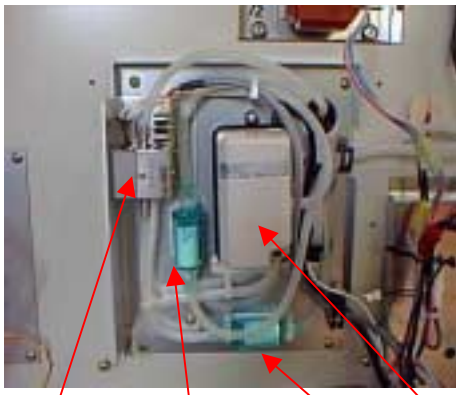
Parts layout







Sensor box



CO_2 sensor

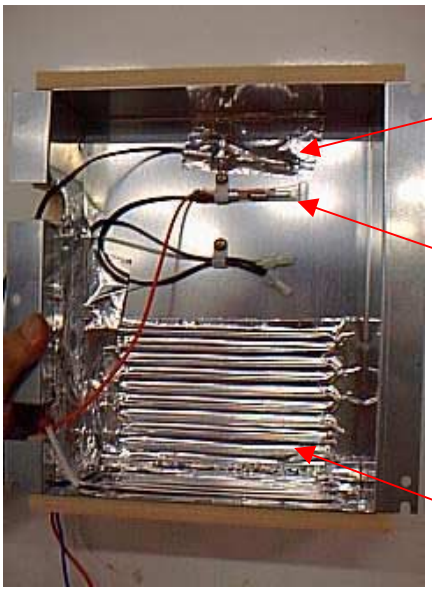
Filter for
CO_2 sensor

circulation pump

Filter for auto zero

Trnsformer
for P.C.B

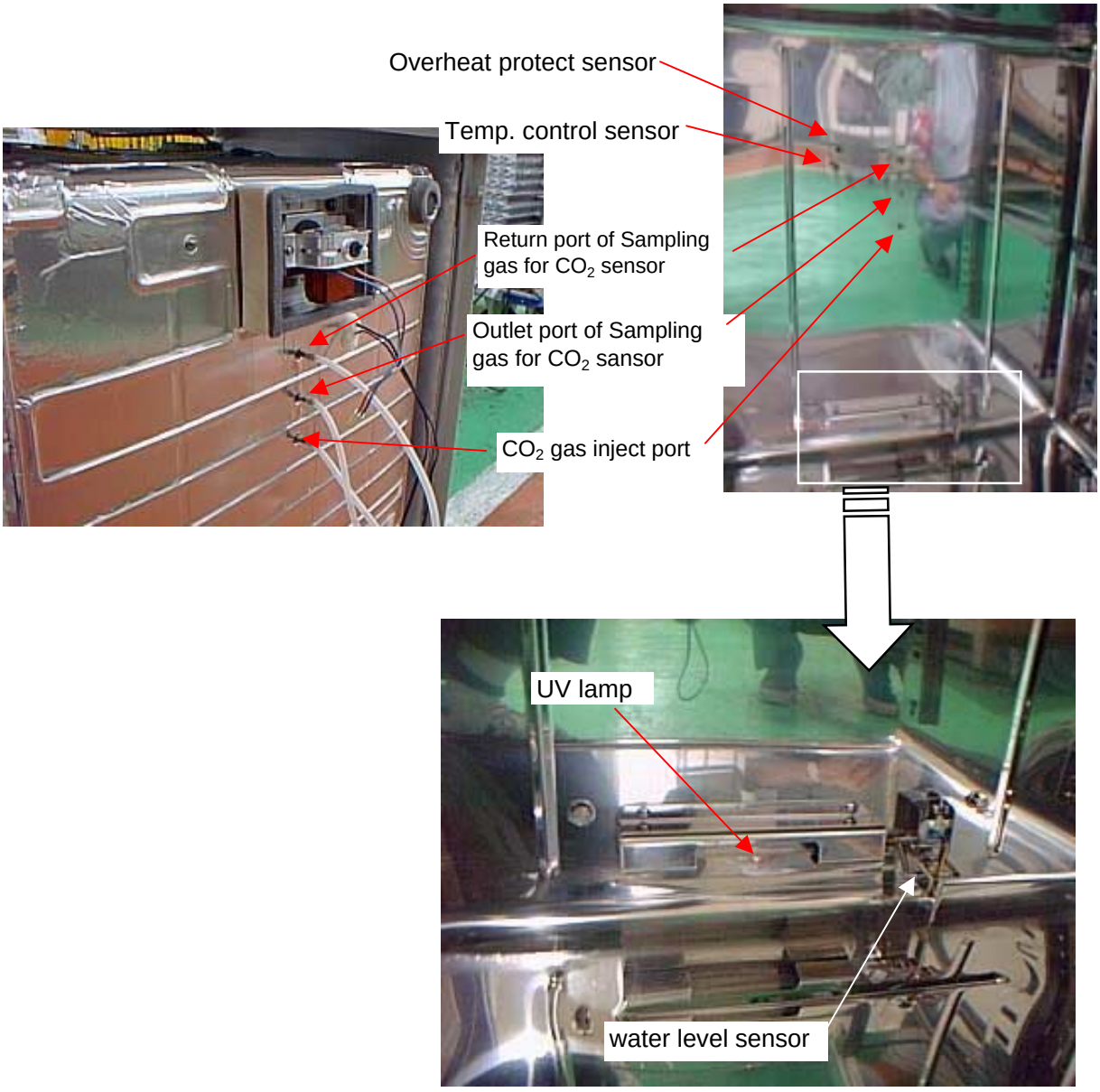
Noise filter



CO_2 sensor box
temp. control sensor

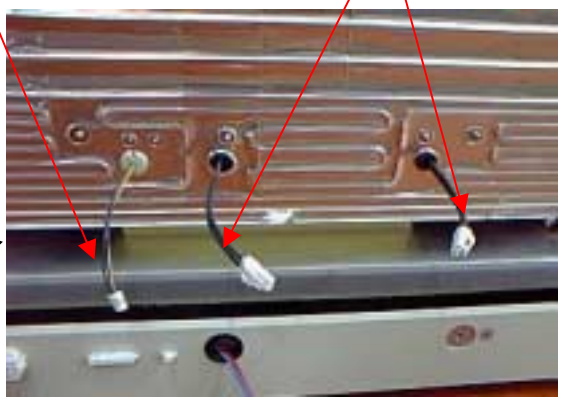
Thermal fuse

CO_2 sensor box heater


Overheat protect sensor
Temp. control sensor
Return port of Sampling gas for CO_2 sensor
Outlet port of Sampling gas for CO_2 sansor
CO_2 gas inject port
UV lamp
water level sensor

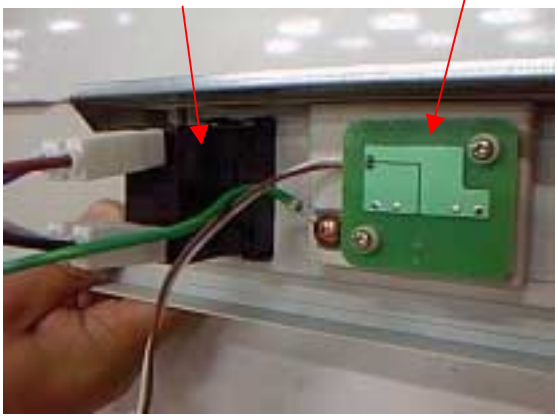
Lead wire of water level sensor

Lead wire of UV lamp socket

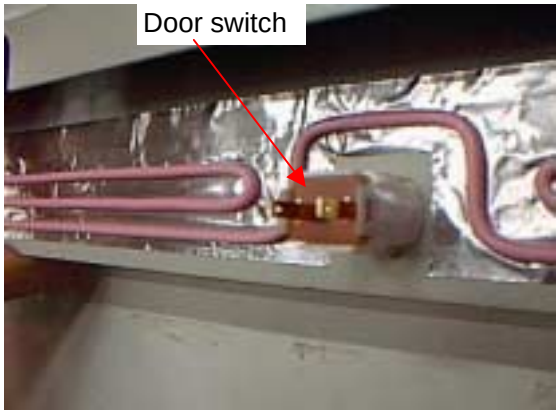


Back side of mains switch

Buzzer P.C.B

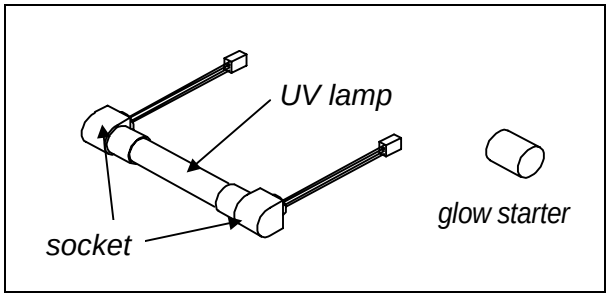


Door switch



How to replace UV lamp

When exchange UV lamp, you will need to replace UV lamp and the socket as a set , sink rubber used for the socket may be deteriorized.
Also at the some time, you will need to replace glow socket as well.



1. *Unplug the unit and check that power is not supplied to the unit, then take the rear cover off.*
2. *Remove the 2 connectors of the lead wire for UV lamp and lead wire hole insulation material.*

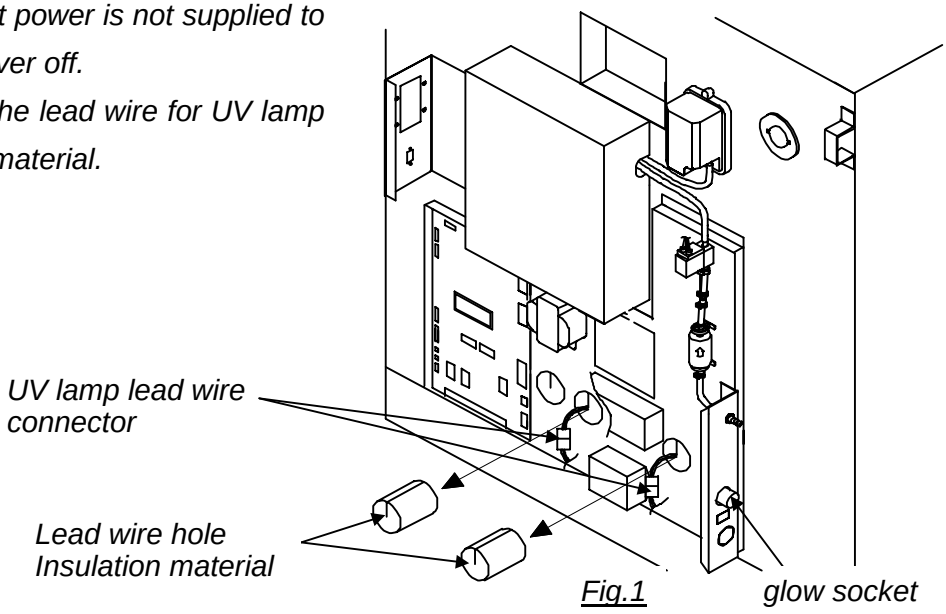


Fig.1

3. *Remove the duct from inside the unit and remove UV lamp cover.*
4. *Hold the socket part of UV lamp and pull toward you.(Take out both UV lamp and the socket.)*
5. *Set new UV lamp (with socket) to the hole and make sure that it is fitted properly.*
6. *Place UV lamp cover and set back the duct.*
7. *Insert the insulation material to the hole of UV lamp lead wire at the backside of the unit and connect with the lead wire.*
8. *Set the rear cover.*
9. *Replace the glow socket (locate as Fig.1)*
10. *Clear the accumulation time of UV lamp. Set function to F04 000.*

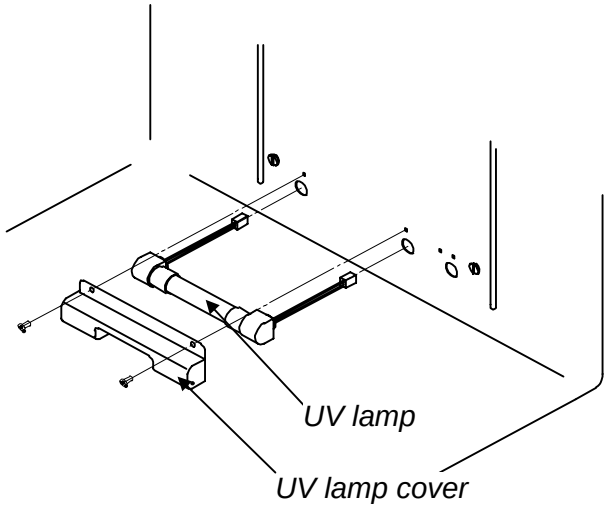


Fig.2

10.Clear the accumulation time of UV lamp.

	Description of operation	*Key operated*	*Indication after operation*
1	*Turn the power switch ON.*	*-*	*The current chamber temperature is displayed.*
2	*Press CAL key for 5 seconds.*	*CAL*	*The left digit in the temperature indicator is flashed.*
3	*By pressing ▶▶ key and ▲ key, set the figure to F03.*	▶▶ ▲	F 0 3
4	*Press ENT key.*	*ENT*	*In CO_2 density indicator, "000" is displayed and the right digit is flashed.* F 0 3 0 0 0
5	*By pressing ▶▶ key and ▲ key, set the figure to 384*	▶▶ ▲	F 0 3 3 8 4
6	*Press ENT key.*	*ENT*	*The current chamber temperature is displayed.*
7	*Press CAL key for 5 seconds.*	*CAL*	*The left digit in the temperature indicator is flashed.*
8	*By pressing ▶▶ key and ▲ key, set the figure to F04*	▶▶ ▲	F 0 4
9	*Press ENT key.*	*ENT*	*In CO_2 density indicator, "0**" is displayed and the right digit is flashed.* F 0 4 0 * *
10	*By pressing ▶▶ key and ▲ key, set the figure to 000.*	▶▶ ▲	F 0 4 1 * *
11	*Press ENT key.*	*ENT*	*Setting of MCO-20GC is finished. The current chamber temperature is displayed.*

When checking the UV lamp operation, open the outer door and push the door switch with the inner door closed.

The recommended timing of lamp replacement (the ratio of UV output is less than 70% of initial value) is when the accumulated ON time is over 1,000 hours. The blink of the UV indicator when the UV lamp is OFF means the accumulated time has exceeded 1,000 hours and recommends the replacement of the lamp.

How to replace water level sensor

1. *Unplug the unit and check that power is not supplied to the unit, then take the rear cover off.*
2. *Unfasten the connectors for lead wire and take out the insulation for the lead wire hole.*

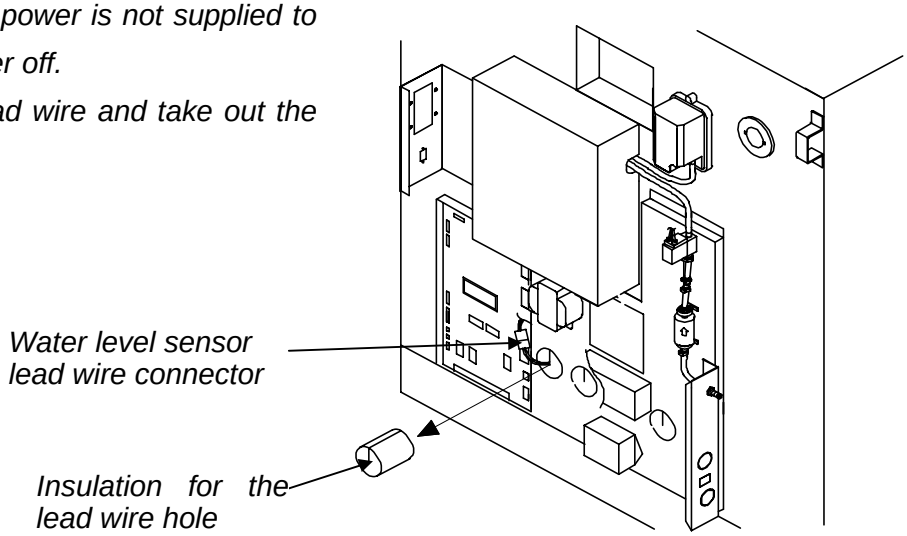


Fig.1

3. *Take out the duct from inside.*
4. *Unfasten the 2 screws to remove unit of water level sensor and installation grommets for water level sensor.*
5. *replace water level sensor.*

   Note Be sure to set the water level sensor to the right direction.
6. *Place back the water level sensor, Water sensor installation grommet as before.*
7. *Place back the insulation material to the hole for the lead wire.*

   Note Be careful for the length of lead wire for water level sensor inside the unit Length is connect 2nd binder is located where it touches the water level sensor grommet.
   (refer to Fig.4)

   Note If there is a V cut for water level installation grommet, pls secure a space for this V cut.(Refer to Fig.3)

   3.Put the rear cover in place.

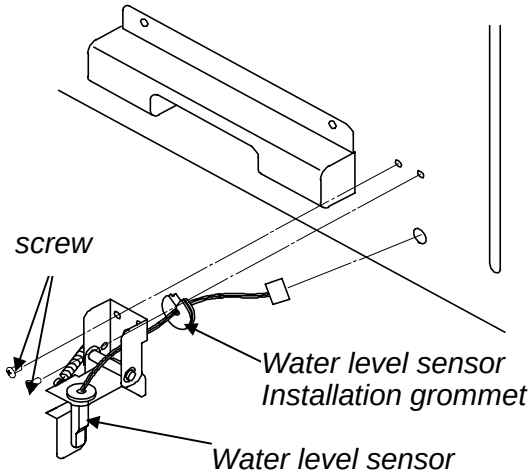


Fig.2

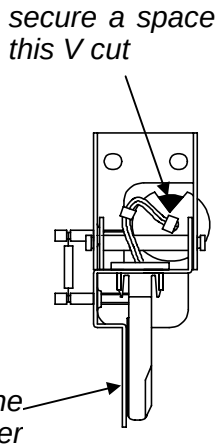


Fig.3 Front view

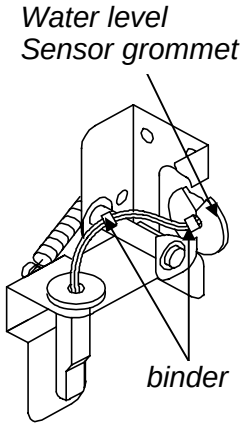
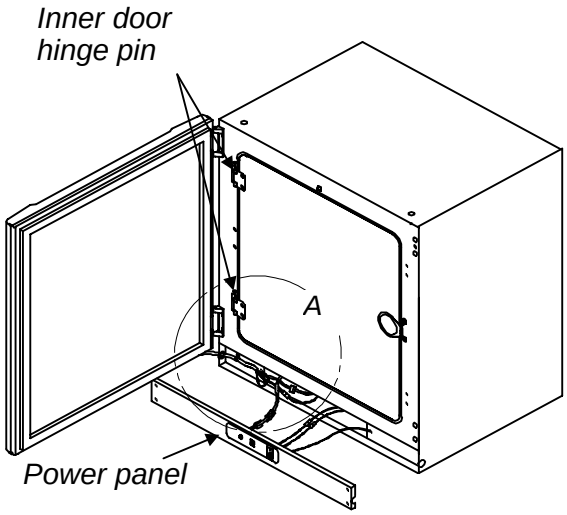


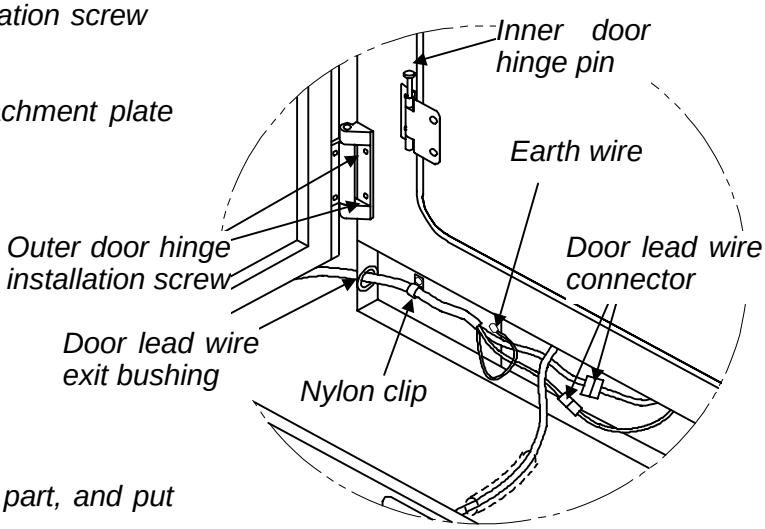
Fig.4

How to reverse the door

1. *Unplug the unit and make sure that power is not supplied*
2. *Take the inner, and outer door off.*
   - *(1) Take out power panel which is at the front side.(4 screws)*
   - *(2) Pull out the inner door hinge pin(2pcs), take the inner door off.*
   - *(3) Remove 2 part of the connector door lead wire , earth wire and nylon clip. Then remove the door lead wire exit bushing and take the lead wire out.*
   - *(4) Remove 4pcs of outer door hinge installation screw and take off the outer door.*

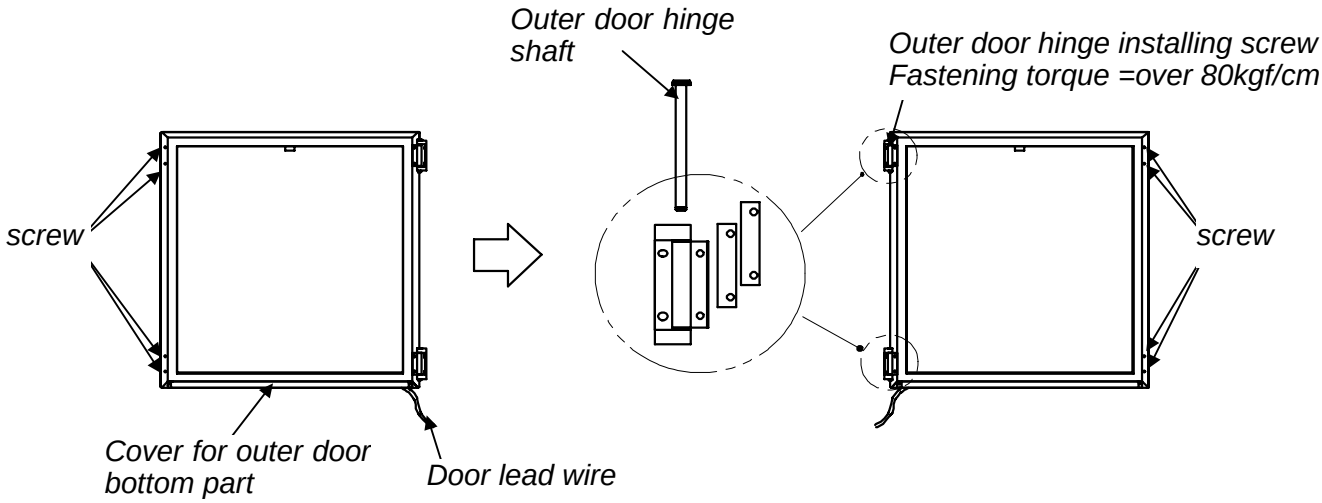
     Note Pls Be careful not to lose the attachment plate for outer door hinge.





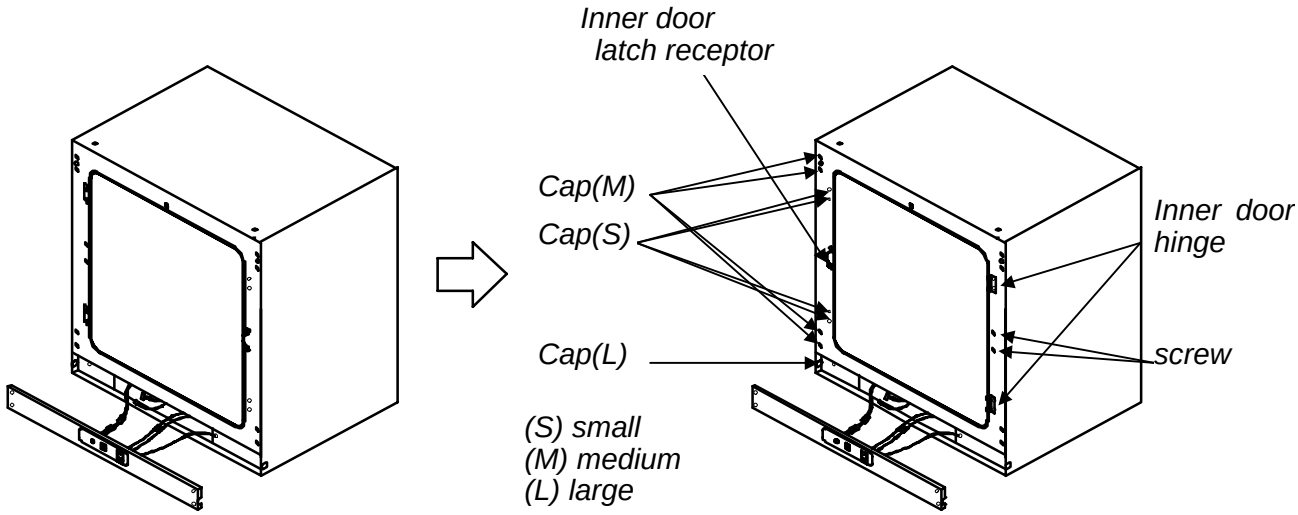
A part details

3. *Preparation to reverse the door it self.*
   - *(1) Remove the cover of outer door bottom part, and put out the lead wire to the opposite side, and put the cover back on.*
   - *(2) Place the hinge and screws of outer door to the opposite side. Also at this time reverse the hinge shaft upside down.*



4.Preparation to reverse the unit

(1) Cap for screw (M), small cap(S), cap for lead wire exit (L), inner door hinge, inner door latch receptor, screws to be reversed.



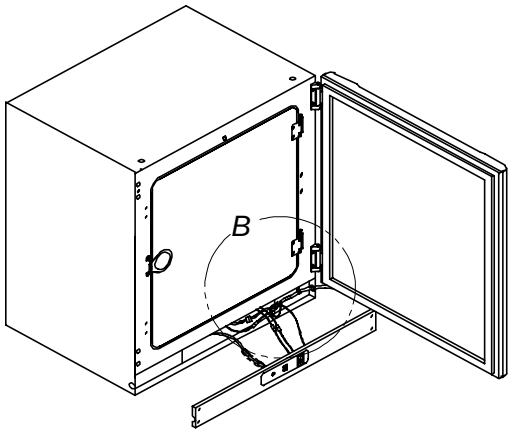
5.Place inner, outer door.

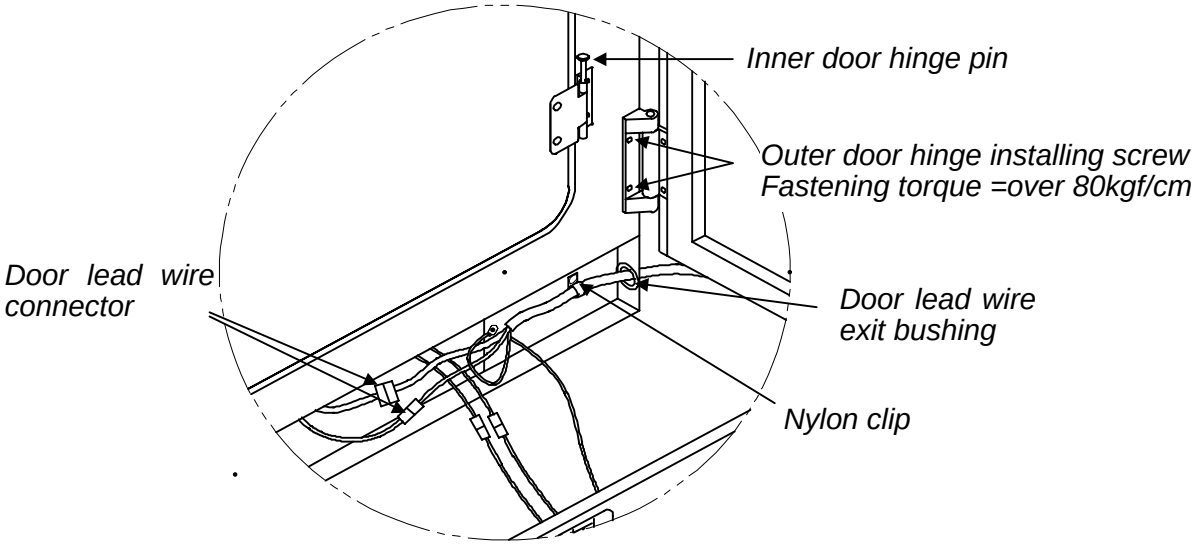
(1) Place the door to the unit, lead wire connector 2 place, earth wire to be put back, and fasten by nylon clip.

Note Be careful that the lead wire will not be too short when fastening with nylon clip.

(2) Place a bushing at lead wire exit part and place back the power panel.

(3) Place inner door upside down.

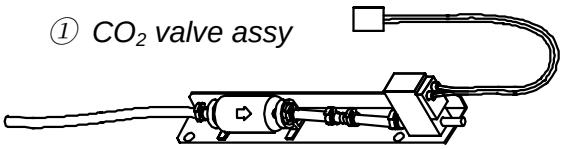




B part details

Mounting procedure of MCO-20GC

Parts list



① CO_2 valve assy

② y-pipe assy

③ connecting port for CO_2 gas pipe

④ nut

⑤ spring washer

⑥ tube band (L)

⑦ tube band (S)

⑧ screw : 2pcs

Mounting procedure

1.Disconnect the power cable and make sure that the unit is not supplied with the power.

2.Remove the rear cover by unscrewing the 6 fixing screws.

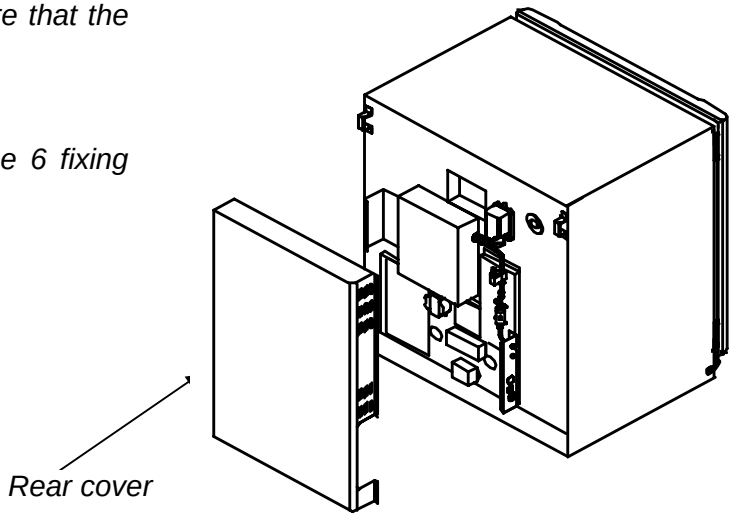


Fig.1

3.Fix ① by using the enclosed screws(⑧).

4.Remove cap and fix ③ with ④ and ⑤.

5.Connect the wiring harness of CO_2 valve B to wiring harness from CN9 on Main board.

6.Disconnect upper tube of CO_2 valve A.
Connect CO_2 valve A and CO_2 valve B and tube X by using ② as shown in Fig.3.

7.Connect bottom tube of ① to ③.

8.Connect ③ with CO_2 gas supply line B.

9.Fix tubes securely using ⑥ and ⑦ as shown in Fig.3.

10.Replace the rear cover.

<u>NOTE: Every tubes should be connected surely to prevent CO_2 leakage.</u>

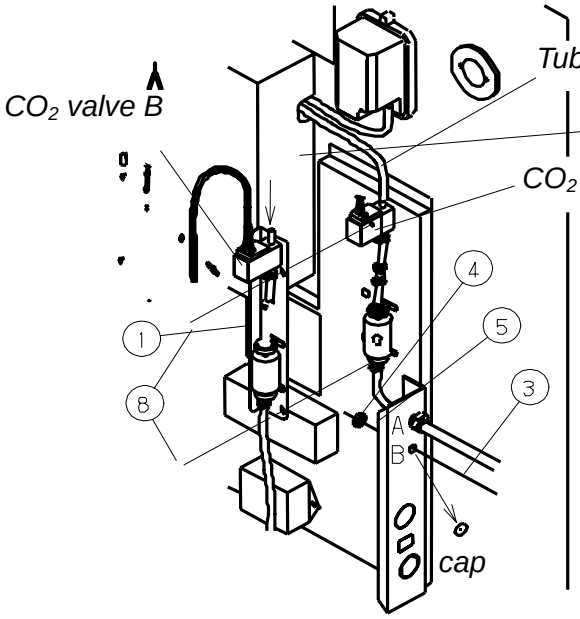


Fig.2

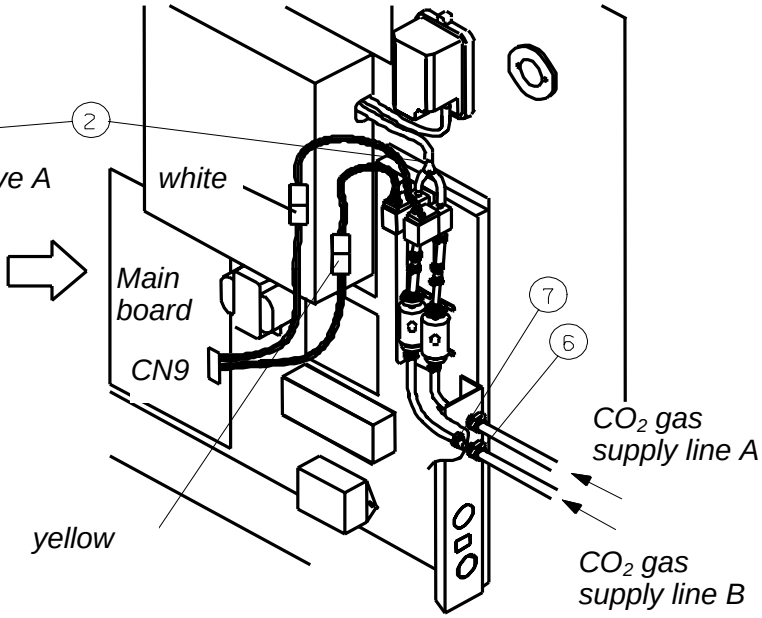


Fig.3

Setting procedure of Control panel.

When use MCO-20GC(the automatic switcher of CO_2 gas supply line),it is necessary to set the MCO-20AIC automatic gas switching mode according to the following procedures.

	Description of operation	*Key operated*	*Indication after operation*
1	*Turn the power switch ON.*	*-*	*The current chamber temperature is displayed.*
2	*Press CAL key for 5 seconds.*	*CAL*	*The left digit in the temperature indicator is flashed.*
3	*By pressing ▶▶ key and ▲ key, set the figure to F03.*	▶▶ ▲	F 0 3
4	*Press ENT key.*	*ENT*	*In CO_2 density indicator, "000" is displayed and the right digit is flashed.* F 0 3 0 0 0
5	*By pressing ▶▶ key and ▲ key, set the figure to 384*	▶▶ ▲	F 0 3 3 8 4
6	*Press ENT key.*	*ENT*	*The current chamber temperature is displayed.*
7	*Press CAL key for 5 seconds.*	*CAL*	*The left digit in the temperature indicator is flashed.*
8	*By pressing ▶▶ key and ▲ key, set the figure to F08*	▶▶ ▲	F 0 8
9	*Press ENT key.*	*ENT*	*In CO_2 density indicator, "0**" is displayed and the right digit is flashed.* F 0 8 0 * *
10	*By pressing ▶▶ key and ▲ key, set only the left digit figure to 1.* *<u>NOTE: Don't change center digit figure and right digit figure.</u>*	▶▶ ▲	F 0 8 1 * * *"*" means "0" or "1".*
11	*Press ENT key.*	*ENT*	*Setting of MCO-20GC is finished.* *The current chamber temperature is displayed.* *CO_2 gas supply line indicator A is lighted.*

Procedure for automatic gas switching operation check.

When the installation of MCO-20GC is completed, check the automatic gas switching operation according to the following procedures.

	procedure
1	*Stop the gas supply of cylinder A and use cylinder B only for CO_2 gas supply.*
2	*Turn on the power switch of MCO-20AIC and set 37℃ and 0%.* *Turn on CO_2 gas supply line indicator A with CO_2 gas supply line switching key.*
3	*Wait for 1 hour approx , until the machine control the CO_2 density.* *(It takes about 1 hour from turning on the power switch until CO_2 control is enabled.)*
4	*Set CO_2 density 5% and check the CO_2 inject lamp A turns on.* *NOTE: In case of low ambient temperature, it may take more than 1 hour until the machine can control CO_2 density and the CO_2 inject lamp turns on.*
5	*Check the E01(CO_2 gas cylinder empty alarm) and buzzer turn on about 2-7minutes later from the CO_2 inject lamp's turning on.* *In this case the gas cylinder A lamp should be blinking, and the gas cylinder B lamp should be on.*
6	*Check the CO_2 gas density indicator reaches to the set value 5% and keep it stably.* *NOTE: CO_2 density control is interrupted when automatic calibration of CO_2 sensor is activated and the decimal point of CO_2 density indicator blinks.*
7	*All the procedure are completed.* *Shut down the CO_2 supply of cylinder A and cylinder B.* *Turn off "E01" display with the buzzer key and select cylinder A with CO_2 gas supply line switching key.* *Turn off the main power switch.*

∗ For proper use, refer to the instruction manual of MCO-20AIC.

How to stack MCO-20AIC

This unit can be stacked by using the stacking kit. Following shows the procedure for stacking the unit. Consult with a Sanyo representative or agent prior to stacking procedure as such work involves dangers.

⚠WARNING

Select a level and sturdy floor having enough strength for installation of stacked module.
Never stack 3 or more units.
Take care not to drop or tip over the unit when stacking as this can cause injury or damage of the unit.

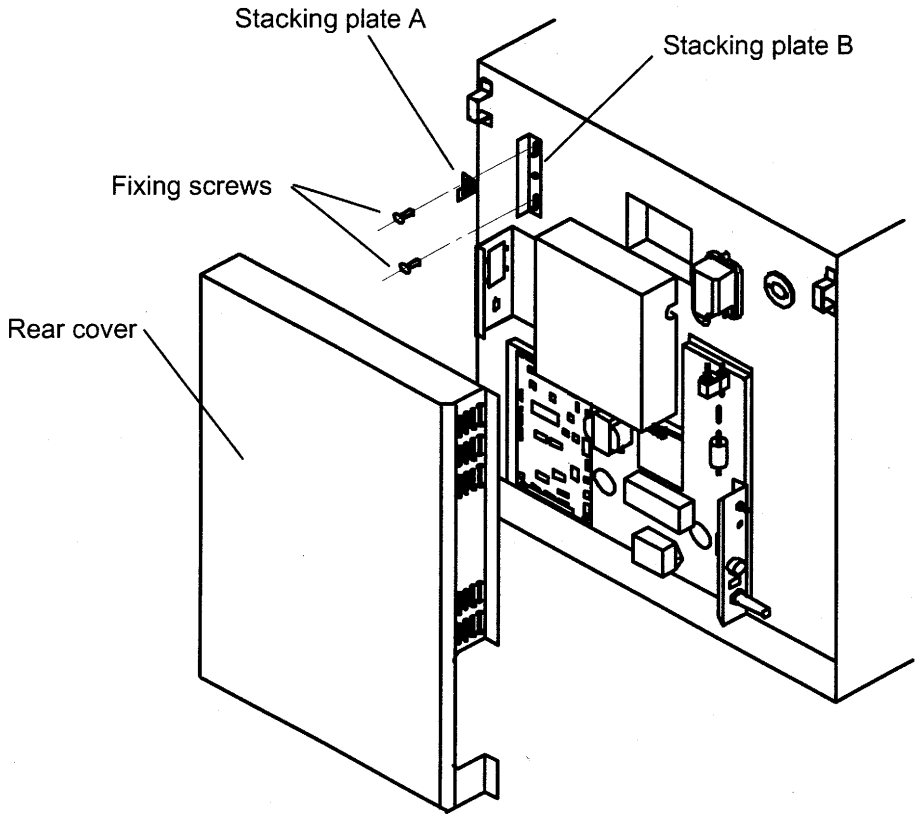
1. Turn off the power switch and disconnect a plug of each unit.

2. The stacking plate A and B are attached on the back of each unit. To prepare the stacking plate A and B, remove the rear cover by unscrewing 6 screws on the rear cover. See the figure below.

3. Take out the stacking plate A and B by loosening 2 fixing screws on each unit.

4. Replace the rear cover and fix it with 6 screws.

5. Check that the lower unit is level.



6. Apply the protective sticker enclosed with the unit at each corner on the top of the lower unit to avoid scratches or damage.

7. Fix the stacking plate A at 2 locations on the top front of the lower unit by using 2 screws removed in step 3.

8. Remove the front panel on the upper unit by unscrewing the 4 fixing screws and then disconnect the wires and gas tube.

9. Stack the unit so that both units can be aligned straight. Also check the upper unit is level. If it is not level, keep the unit even by adjusting the leveling legs.

10. Secure the upper unit with the stacking plate A and 2 screws removed in step 3.

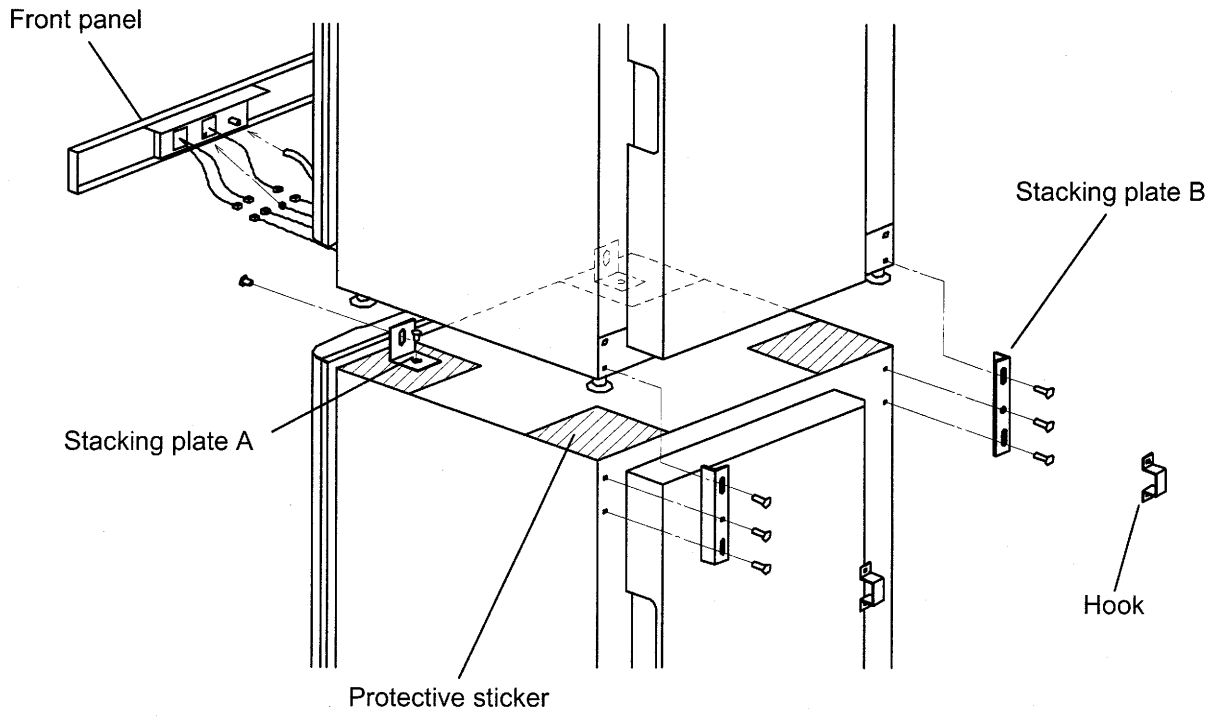
11. Remove 2 hooks on the rear side of the lower unit by unscrewing each 2 fixing screws.

12. Remove 1 screw on the bottom right and left on the rear side of the upper unit.

13. Fix the stacking plate B at the right and left on the rear of the lower and upper unit with 3 screws removed in step 11 and 12.

14. Replace the front panel on the upper unit after connecting the wires and gas tube.

15. Fix the stacked unit to the wall with 2 hooks on the rear of the upper unit and rope or chain.



User's Manual

・This section is extracted and printed from User's Manual.

・If you find out "Refer to page ●●" in them, this page means not page in service manual but page in the lower corner of each page in the extract from user's manual.
This page number is not corresponded with serial page number in Service manual.

SANYO

INSTRUCTION MANUAL

MCO-20AIC

CO_2 Incubator

Contents

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Note:

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2. **The contents of this manual are subject to change without notice.**
3. **Please contact SANYO if any point in this manual is unclear or if there are any inaccuracies.**

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PRECAUTIONS FOR SAFE OPERATION

It is imperative that the user complies with this manual as it contains important safety advice.

Items and procedures are described so that you can use this unit correctly and safely. If the precautions advised are followed, this will prevent possible injury to the user and any other person.

Precautions are illustrated in the following way:

⚠WARNING

Failure to observe WARNING signs could result in a hazard to personnel possibly resulting in serious injury or death.

⚠CAUTION

Failure to observe CAUTION signs could result in injury to personnel and damage to the unit and associated property.

Symbol shows;

△ this symbol means caution.

⃠ this symbol means an action is prohibited.

● this symbol means an instruction must be followed.

Be sure to keep this manual in a place accessible to users of this unit.

PRECAUTIONS FOR SAFE OPERATION

⚠WARNING

Do not use the unit outdoors. Current leakage or electric shock may result if the unit is exposed to rain water.

Only qualified engineers or service personnel should install the unit. The installation by unqualified personnel may cause electric shock or fire.

Install the unit on a sturdy floor. If the floor is not strong enough or the installation site is not adequate, this may result in injury from the unit falling or tipping over.

Never install the unit in a humid place or a place where it is likely to be splashed by water. Deterioration of the insulation may result which could cause current leakage or electric shock.

Never install the unit in a flammable or volatile location. This may cause explosion or fire.

Never install the unit where acid or corrosive gases are present as current leakage or electric shock may result due to corrosion.

Use a dedicated power source as indicated on the rating label attached to the unit.

Remove dust from the power supply plug before inserting in a power source. A dusty plug or improper insertion may pose a hazard.

Use a power supply outlet with ground (earth) to prevent electric shock. If the power supply outlet is not grounded (earthed), it will be necessary to install a ground by qualified engineers.

Never ground the unit through a gas pipe, water main, telephone line or lightning rod. Such grounding may cause electric shock in the case of an incomplete circuit.

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO_2 gas. Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.

Do not insert metal objects such as a pin or a wire into any vent, gap or any outlet for inner air circulation. This may cause electric shock or injury by accidental contact with moving parts.

Never store volatile or flammable substances in this unit. This may cause explosion or fire.

PRECAUTIONS FOR SAFE OPERATION

⚠WARNING

As with any equipment that uses CO_2 gas, there is a likelihood of oxygen depletion in the vicinity of the equipment. It is important that you assess the work site to ensure there is suitable and sufficient ventilation. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices.

Ventilate a room air occasionally when using CO_2 gas for control. The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO_2 gas is used.
Si l'appareil est utilisé dans un evdroit restreint, le niveau de la densité CO_2 de l'air peut s'élever et peut être nocif aux humains. Évitez d'aspirer l'air provenant de l'intérieur de l'appareil quand vous ouverz la porte.

Use this unit in a safe area if using poisonous, harmful or radioactive substances. Improper use may be harmful to your health or the environment.

Never expose the eyes directly to UV light as UV light can cause permanent damage to eyes.

Disconnect the power supply to the unit prior to any repair or maintenance in order to prevent electric shock or injury.

Ensure you do not inhale or consume medication or aerosols from around the unit at the time of maintenance. These may be harmful to your health.

Never splash water directly onto the unit as this may cause electric shock or short circuit.

Never disassemble, repair, or modify the unit yourself. Any such work carried out by an unauthorized person may result in fire or injury due to a malfunction.

Disconnect the power supply plug if there is anything wrong with the unit. Continued abnormal operation may cause electric shock or fire.

If the unit is to be stored unused in an unsupervised area for an extended period, **ensure that children do not have access and that doors cannot be closed completely.**

The disposal of the unit should be undertaken by appropriate personnel. Remove doors to prevent accidents such as suffocation.

Prepare a safety check sheet when you request any repair or maintenance for the safety of service personnel.

PRECAUTIONS FOR SAFE OPERATION

⚠CAUTION

Select a level and sturdy floor for installation. This precaution will prevent the unit from tipping. Improper installation may result in water spillage or injury from the unit tipping over.

Connect the unit to a power source as indicated on the rating label attached to the unit. Use of any other voltage or frequency other than that on the rating label may cause fire or electric shock.

Fix the shelves securely. Incomplete installation may cause injury or damage.

When removing the plug from the power supply outlet, grip the power supply plug, not the cord. Pulling the cord may result in electric shock or fire by short circuit.

Never damage or break the power supply plug or cord. Do not use the supply plug if its cord is loose. This may cause fire or electric shock.

Do not touch any electrical parts such as the power supply plug or any switches with a wet hand. This may cause electric shock.

Do not put a container with water or heavy articles on the unit. It may cause injury if the articles fall. Current leakage or electric shock may result form deterioration of insulation by spilled water.

Do not climb onto the unit and do not put articles on the unit. This may cause injury by tipping or damage to the unit.

Never lean or press on the glass. Intentional force may cause injury if the glass breaks.

Do not lean on the door. This may cause injury, current leakage, or electric shock if the unit tips over or door becomes detached.

Disconnect the power supply plug before moving the unit. Take care not to damage the power cord. A damaged cord may cause electric shock or fire.

Empty the humidifying pan completely before moving the unit. Spilled or splashed water may cause current leakage or electric shock.

Be careful not to tip over the unit during movement to prevent damage or injury.

Disconnect the power plug when the unit is not used for long periods.

Do not put the packing plastic bag within reach of children as suffocation may result

CAUTIONS FOR USAGE

1. Install in an appropriate environment

With an automatic calibration function, the CO_2 sensor is calibrated by utilizing air from the local environment. Place the unit in an environment which will reflect normal atmospheric conditions.

2. 5°C higher than the ambient temperature

The chamber temperature must be at least 5°C higher than the ambient temperature. For example, the chamber temperature is set to 37°C, the ambient temperature must be less than 32°C. Ensure the ambient temperature is within the desired range.

3. Do not subject to direct air flow

Do not place the unit in the direct air flow from an air conditioning system. Cool air from an air conditioning system may cause condensation and lead to possible contamination.

4. Always keep the chamber clean

The Petri dishes or bottles for culturing may cause contamination in the chamber. Clean the containers before storing them in the chamber.

5. Allow adequate space between the cultures

When storing cultures in the chamber, keep the Petri dishes or bottles containing the cultures sufficiently apart from each other to allow adequate air circulation. Inadequate space may result in uneven temperature distribution and CO_2 concentration in the chamber.

6. Always shut the inner door

Shut the inner door completely, and then shut the outer door. If the inner door is not closed completely, even if the outer door is closed, the unit will fail to exhibit its maximum performance. Ensure you close the doors gently. Robust closing may cause spillage of medium, incomplete closing, or damage of gasket. Before opening the inner door, check that the UV light is OFF.

7. Keep the inside panels dry

To protect the inside of the unit from contamination, the inside panels should always be kept dry. If water is spilled from the humidifying pan or if the door is kept open for a long period, condensation will form on the panels, allowing bacteria or fungi to breed. If this occurs, wipe away the water with a dry sterile gauze. Particularly, if the medium is spilled, wipe it up immediately and sterilize the area.

8. Fill the humidifying pan with sterile distilled water

Always use sterile distilled water to fill the pan. The RH PAN light on the control panel flashes when the water level is low. Refill the sterile distilled water to the pan when the RH PAN light blinks. Note that when low temperature water is poured, the chamber temperature drops significantly. Clean the pan once a month.

9. Humidifying pan and pan cover

The humidifying pan and pan cover prevent the UV light from escaping. Make sure they are installed even if you do not need humidity. Install the pan cover correctly since it affects the temperature distribution and humidity recovery in the chamber.

CAUTIONS FOR USAGE

10. Stored materials

Never place acid or alkaline materials or materials that release corrosive gas in the chamber. Such materials can cause failure resulting from discoloration or corrosion.

11. Alarm

Always investigate the cause and fix the alarm condition immediately when the alarm is activated. Refer to page 20 for alarm details.

12. Never use CAL key

Never use CAL key during normal operation because the calibration mode is started by pressing this key. Wrong operation of this key will give an adverse effect on the basic performance of the unit. If you press this key accidentally, do not press any keys on the control panel for 90 seconds, after which the unit returns to the display mode automatically.

13. UV lamp

The UV lamp is OFF when the outer door is opened as it is operated to outer door switch. Check the UV lamp is ON with the inner door closed once a month by activating the outer door switch. If the lamp is not ON, the lamp needs to be replaced. Contact Sanyo sales representative or agent.

The UV lamp is located in the duct. Take care not to damage the lamp at the time of installation/removal of attachments or humidifying pan.

Note: UV light is harmful to the eyes. Never turn on the UV lamp with the inner door opened.

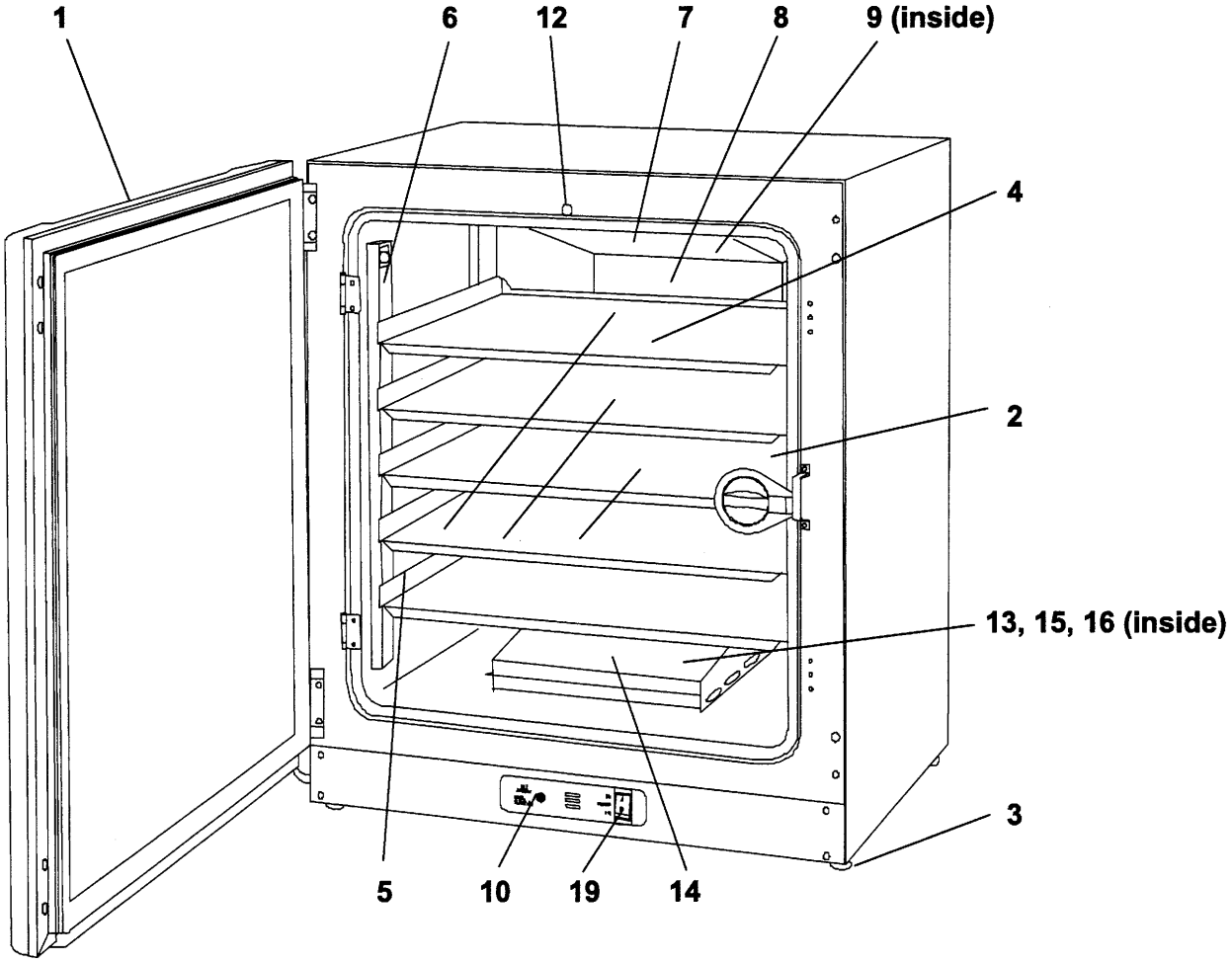
14. Notice of recommended replacement of UV lamp

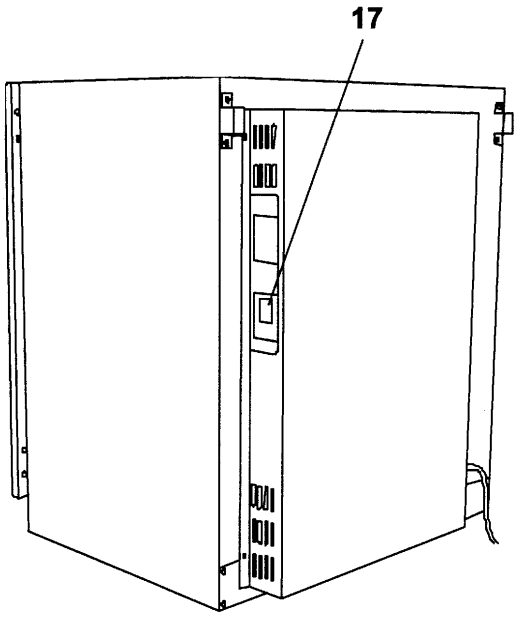
This unit is provided with a function to notify the recommendation of UV lamp replacement when the accumulated ON time of UV lamp is over about 1,000 hours. The blink of the UV indicator on the control panel recommends the replacement of UV lamp. For the replacement, contact Sanyo sales representative or agent.

15. If not used for a long period

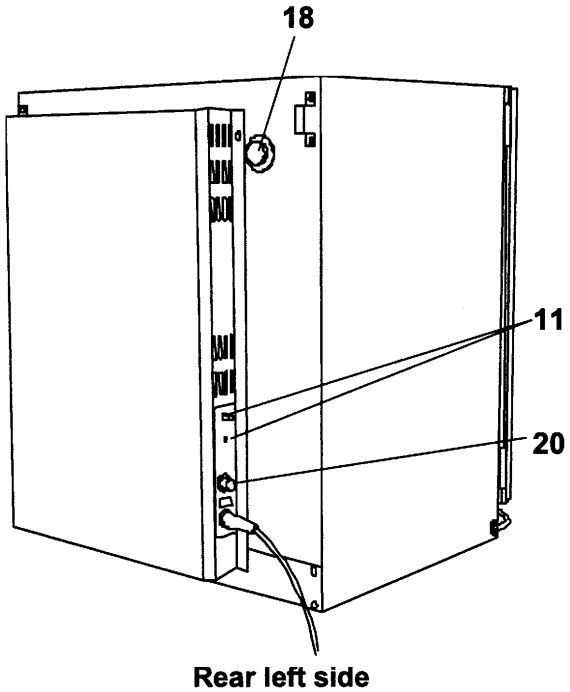
When the unit is not used for a long period, dispose of the water in the humidifying pan and completely remove any moisture in the chamber completely. Check that the chamber is completely dry before closing the doors.

INCUBATOR COMPONENTS





Rear right side



Rear left side

INCUBATOR COMPONENTS

1. Outer door: Sticks to frame with magnetic seal. Door heater is installed in the door panel. The heater eliminates moisture on the inner door. The door opening is reversible. Contact Sanyo representative or agent to change the door hinge from left to right or vice versa.

2. Inner door: Made of tempered glass. Avoid excessive impact on the glass.

3. Leveling foot: Used for leveling the unit.

4. Tray: Can be pulled toward you.

5. Tray support: Can be removed by lifting the front side and pulling toward you.

6. Side support: Right and left side supports can be removed for disinfection. See page 23 and 24.

7. Top duct: Inlet of circulating air. Removable.

8. Rear duct: Flow path for circulating air. Removable.

9. Fan (inside the rear duct): Made from polypropylene resin. Can be disinfected by an autoclave.

10. Sample air outlet: This also functions as an internal gas outlet, so do not cap it.

11. Connecting port for CO_2 gas pipe (rear side): When an optional component MCO-20GC (cylinder changeover accessory) is installed, both A and B are available. If MCO-20GC is not used, only A is available. Refer to page 14 for gas cylinder connection. Ensure that the gas pressure is set at 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG).

12. Door switch: Detects the door opening/closing and stops the circulating fan and electromagnetic valve for CO_2 when door is open. UV lamp is also deactivated by door opening.

13. Humidifying pan: Use sterile distilled water to fill the pan. Install the pan properly so that it can be covered with the pan cover.

14. Humidifying pan cover: Prevents UV light being exposed to the chamber. When filling the pan, lift the front side and take out the pan. See page 23 for details.

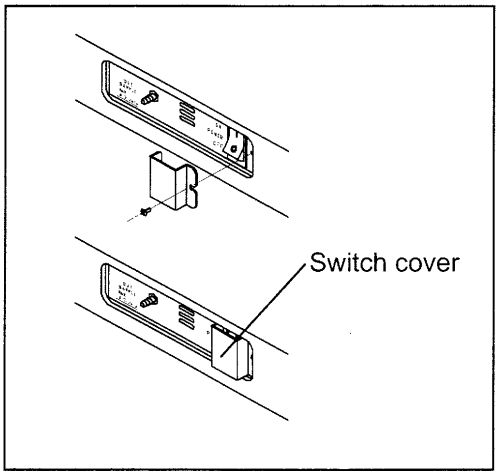
15. UV lamp: Sanyo UV lamp does not generate ozone. Never look at the UV light directly. For replacement, contact Sanyo representative or agent.

16. Water level sensor for humidifying pan: Located at the rear of the chamber and detects the water level in the humidifying pan. Never use excessive force on the sensor during maintenance.

17. Remote alarm terminal: Refer to page 21.

18. Access port: When not in use, cap with the rubber cap on both outside and inside.

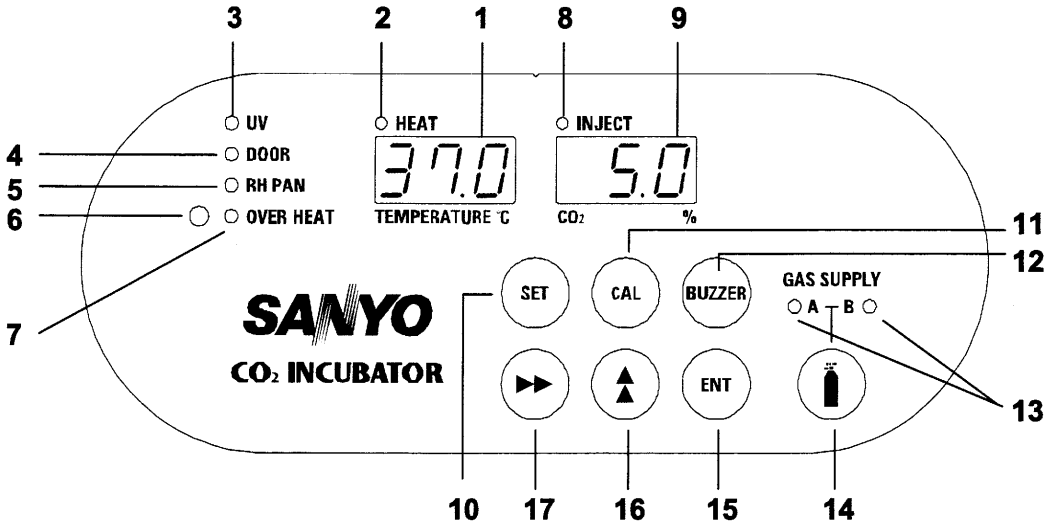
19. Power switch: Main switch of the unit. Also functions as an over-current breaker (15A). The switch is covered by a switch cover to prevent the accidental push. To turn on or off the switch, remove the switch cover by loosening the screw. See figure on the right.



20. Glow lamp: For UV lamp (model; FG-7P)

INCUBATOR COMPONENTS

Control panel and keypad



1. Digital temperature indicator (TEMPERATURE °C): Normally, this indicator shows the chamber temperature. In the setting mode, it shows the set value of the chamber temperature. If the self diagnostic function detects any abnormality, an error code will be displayed.

2. Heater lamp (HEAT): This lamp lights when the heater is energized.

3. UV indicator (UV): This lamp lights when the UV lamp is ON. The blink of this indicator recommends the replacement of UV lamp. See page 17 for the details.

4. Door lamp (DOOR): This lamp lights when the outer door is open.

5. Water level alarm lamp (RH PAN): This lamp flashes when the water in the humidifying pan is less than approximately 1 liter.

6. Upper limit regulator: This regulator is used to set the upper temperature limit.

7. Over heat lamp (OVER HEAT): This lamp lights when the chamber temperature reaches the upper limit set value.

8. CO_2 inject lamp (INJECT): This lamp lights when CO_2 gas is being injected.

9. Digital CO_2 density indicator (CO_2 %): Normally, this indicator shows the CO_2 concentration in the chamber. In the setting mode, it indicates the set value of the CO_2 concentration.

10. Set key (SET): Pressing this key to enter the setting mode, and the digits to be set will flash.

11. Calibration key (CAL): By pressing this key for approximately 5 seconds, the unit enters calibration function mode. Used to change the UV lamp ON period.

12. Alarm buzzer stop key (BUZZER): Press this key to silence the buzzer when the alarm operates and the buzzer sounds. The remote alarm also stops by pressing this key. Press it once again to reactivate the buzzer.

13. CO_2 gas supply line indicator (A/B): The lamp for the supply line currently in use lights up provided that MCO-20GC changeover accessory is installed. This will flash when either gas cylinder is empty.

14. CO_2 gas supply line switching key : This key to select CO_2 gas supply line is available only when an automatic cylinder changeover MCO-20GC (option) is installed. When one CO_2 cylinder is empty, the CO_2 is supplied by the other cylinder automatically. But if necessary, by pressing this key, the supply line can be switched between A and B manually.

15. Enter key (ENT): Pressing this key memorizes the set value in the controller.

16. Numerical value shift key (▲): Pressing this key in the setting mode causes the numerical value to shift. In key lock mode, pressing this key makes key lock ON or OFF.

17. Digit shift key (▶▶): Pressing this key in the setting mode causes the changeable digit to shift. Pressing this key more than 5 seconds enters key lock mode. See page 18 for the key lock.

INSTALLATION

Installation site

To operate this unit properly and to obtain maximum performance, install the unit in a location with the following conditions:

Note: The ambient temperature must be at least 5°C lower than the set temperature.

1. **A location not subjected to direct sunlight or direct air flow from an air conditioner**

2. **A location with clean air and adequate ventilation** (Small and sealed room is not recommended.)

> ⚠ **WARNING**
> **If the unit is used in a small confined room, the CO_2 density level in the air could rise and may be harmful to humans.**

3. **A location away from heat generating sources**

4. **A location with a sturdy and level floor**

> ⚠ **WARNING**
> **Install the unit on a sturdy floor.** If the floor is not strong enough or the installation site is not adequate, this may result in injury from the unit falling or tipping over.
> **Select a level and sturdy floor for installation.** This precaution will prevent the unit from tipping. Improper installation may result in water spillage or injury from the unit tipping over.

5. **A location without flammable or corrosive gas**

> ⚠ **WARNING**
> **Never install the unit in a flammable or volatile location.** This may cause explosion or fire.
> **Never install the unit where acid or corrosive gases are present** as current leakage or electric shock may result due to corrosion.

6. **A location not prone to high humidity**

> ⚠ **WARNING**
> **Do not use the unit outdoors.** Current leakage or electric shock may result if the unit is exposed to rain water.
> **Never install the unit in a humid place or a place where it is likely to be splashed by water.** Deterioration of the insulation may result which could cause current leakage or electric shock.

INSTALLATION

Prevent contamination

To prevent contamination of the chamber, select an appropriate location for installation as well as ensuring the complete disinfection of the chamber components.

1. Avoid hot and humid location

Avoid location with high temperature and/or humidity as the presence of bacteria in the air is greater than in the normal environment.

2. Avoid drafty location and location with many passers-by

Avoid locations near doors, air conditioners, fans, etc., where slight breezes can facilitate the entry of bacteria into the chamber.

3. Installation in a sterile room

To promote efficient cultivation, it may be best to install the unit in a sterile room.

4. Use clean containers

Contamination is often caused by containers such as Petri dishes or bottles stored in the chamber introducing contamination. Always keep the containers clean.

Installation

1. Remove the packaging materials and tapes

Remove all transportation packaging materials and tapes. Open the doors and ventilate the unit. If the outside panels are dirty, clean them with a neutral detergent and rinse with clean water.

2. Adjust the leveling feet

Extend the leveling feet by rotating them counterclockwise so they contact the floor or bench. Ensure the unit is level.

3. Fix the unit

Two fixtures are attached to the rear of the frame. Fix the frame to the wall with these hooks and rope or chain.

4. Ground (earth)

⚠WARNING

Use a power supply outlet with ground (earth) to prevent electric shock. If the power supply outlet is not grounded, it is necessary to install a ground by qualified engineers.

Never ground the unit through a gas pipe, water main, telephone line or lightning rod. Such grounding may cause electric shock in the case of an incomplete circuit.

BEFORE COMMENCING OPERATION

Sterilizing of chamber and attachments

Before first start-up of the unit, the chamber and internal attachments should be cleaned and sterilized as follows.

Note:
Take care not to damage the UV lamp or water level sensor at the time of removal or replacement of attachments.
Do not clean the inside of the unit with a solution of disodium chlorate or other halogen-based solution because this may cause corrosion of metal surfaces.

1. Take out all attachment such as trays, humidifying pans, etc, from the chamber. Refer to page 23 and 24.

2. Clean all of the attachments with neutral detergent and then wash out the detergent with distilled water.

3. Wipe the attachments with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

4. Wipe the inside wall of the chamber with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

5. Replace all attachments in the chamber.
Note:
Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

6. Fill the humidifying pan with sterile distilled water.

BEFORE COMMENCING OPERATION

Connection of CO_2 gas cylinder

⚠WARNING

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO_2 gas. Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.

Use a liquefied CO_2 gas cylinder, not a siphon (dip tube) type. The CO_2 gas should be 99.5% or more pure.
Install a pressure regulator on the cylinder. Use a regulator rated at 25MPa on the primary side and 0.2MPa on the secondary side. Use the following procedure to attach the incubator to the cylinder:

1. Using the gas supply pipe provided, connect the pressure regulator to the CO_2 inlet located at the rear left hand side of the CO_2 incubator.

2. Set the CO_2 pressure on the secondary side to 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG). Excessive pressure may cause disconnection of internal pipes inside the CO_2 incubator which will result in leakage of CO_2 gas into the atmosphere. **Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.**

3. Check that no gas is leaking at any point where the pipe connects with the CO_2 regulator or the CO_2 incubator.

Note:
The incubator, including the gas supply pipes and services must be examined at frequent intervals to ensure they are safe. Ensure that items such as pipes are replaced if there is any sign of deterioration.

BEFORE COMMENCING OPERATION

Automatic switcher of CO_2 gas supply line

An automatic switcher of CO_2 gas supply line (MCO-20GC) is available as an optional accessory. This kit switches the gas supply line when one CO_2 gas cylinder is empty.

Note: The installation of MCO-20GC should be implemented by a qualified service personnel.

After attachment of MCO-20GC, do the following:

1. Connect a CO_2 gas pipe to port A and B respectively. A connecting port for CO_2 gas pipe is located on the left back of the unit. (See page 9).

2. Connect a CO_2 gas cylinder provided with a gas pressure regulator to each gas pipe. See page 14, for the connection of the gas cylinder.

3. Open the valve of each gas cylinder.

4. Check that the CO_2 gas supply line indicator on the control panel is lit by pressing the switching key.

5. Select a CO_2 gas supply line (A or B).

6. When one cylinder is empty, the indicator is flashed, buzzer sounds, and "E01" and current chamber temperature are displayed alternately on the control panel while the gas supply line is switched to other one. To silence the buzzer, press the buzzer stop key (BUZZER).

7. Replace the empty CO_2 gas cylinder.

Note: Exercise caution when handling empty CO_2 gas cylinders as some gas can be still be left in the cylinder.

This kit MCO-20GC detects that no more CO_2 gas exists in a cylinder when the CO_2 density in the chamber is not increased after a few minutes of opening of CO_2 gas valve in the unit and switches the gas supply line. The switching of supply line can be caused by some other reasons; blocking or restricting of gas tube, reduction of CO_2 gas pressure, or improper opening of CO_2 gas cylinder, in spite of gas quantity in the cylinder. Therefore, always check the gas quantity in the cylinder prior to disconnection.

OPERATING INSTRUCTIONS

Set of chamber temperature and CO_2 density

Table below shows the basic procedure for setting the chamber temperature and CO_2 density. The upper limit alarm temperature setting is also shown in the table. Perform key operations in the sequence indicated in the table. The example in the table is based on the assumption that the desired temperature is 37°C and CO_2 density is 5%.

Note: The unit is set at the factory so that the chamber temperature is 37°C and CO_2 control is 0%.

Allow at least 4 hours until the next setting after setting of desired chamber temperature and setting CO_2 density to 0%, at the time of first start-up or start-up after no use for long term.

Basic operation sequence (Example: Chamber temperature; 37°C, CO_2 density; 5%)

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	----	The current chamber temperature is displayed in temperature indicator.
2	Press SET key.	SET	The left digit is flashed.
3	By pressing ▶▶ key and ▲ key, set the figure to 37.0.	▶▶	When pressed, the changeable digit is shifted.
		▲	When pressed, the figure of settable digit increases.
4	Press ENT key.	ENT	Set temperature is memorized. Left digit in CO_2 density indicator is flashed.
5	By pressing ▶▶ key and ▲ key, set the figure to 05.0.	▶▶	When pressed, the changeable digit is shifted.
		▲	When pressed, the figure of settable digit increases.
6	Press ENT key.	ENT	Set CO_2 density is memorized.
7	Adjust upper alarm temperature set knob so that the alarm temp. is 1°C higher than chamber temp.		In CO_2 density indicator, HI is displayed. In temperature indicator, 38.0 is displayed.
8	Press ENT key.	ENT	This is the end of set mode and the indicators display current temperature and CO_2 density.

Note:

In each set mode, the indicator returns to the current temperature and CO_2 density display mode automatically when 90 seconds has passed without any key operation.

In each set mode, if the change of the setting is not necessary, pressing SET key skips to next set mode.

When the CO_2 density is set to 00.0, the control is OFF regardless of chamber density.

The upper limit alarm temperature set value will change when the set knob is turned even if the unit is not in set mode, because the alarm circuit is an independent circuit.

OPERATING INSTRUCTIONS

UV lamp

A UV lamp is located inside the rear duct to sterilize the water in the humidifying pan and air circulating in the chamber.
Following shows precautions and instructions about the UV lamp.

* The UV light is exposed only to the inside of the duct and the humidifying pan cover when all chamber components are installed properly.
* During cultivation, ensure all components are located adequately and never turn on the UV light without the humidifying pan cover.
* Even if the unit is operating without turning on the UV lamp, always install the humidifying pan cover. If the pan cover is not used this will affect the temperature distribution and humidify recovery.
* Even if the unit is operated without humidifying, always install the humidifying pan and the humidifying pan cover.
* The UV lamp is turned off when the outer door is opened during ON period.
* When checking the UV lamp operation, open the outer door and push the door switch with the inner door closed.
* The UV lamp is ON for a predetermined period after the outer door is closed. The period is factory set at 5 minutes. Change the setting as necessary as shown in the table below.
* The recommended timing of lamp replacement (the ratio of UV output is less than 70% of initial value) is when the accumulated ON time is over about 1,000 hours. The blink of the UV indicator when the UV lamp is OFF means the accumulated time has exceeded about 1,000 hours and recommends the replacement of the lamp.
* Consult with a Sanyo representative or agent at the time of replacement of UV lamp.

Basic operation sequence (Example: change of UV lamp ON period from 5 minutes to 3 minutes)

	Description of operation	Key operated	Indication after operation
1	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed.
2	By pressing ▶▶ key and ▲ key, set the figure to F01	▶▶	When pressed, the changeable digit is shifted.
		▲	When pressed, the figure of settable digit increases.
3	Press ENT key.	ENT	The current setting is displayed in the CO_2 density indicator.
4	By pressing ▶▶ key and ▲ key, set the figure to 003.	▶▶	When pressed, the changeable digit is shifted.
		▲	When pressed, the figure of settable digit increases.
5	Press ENT key.	ENT	Set value is memorized and the display return to normal display mode.

Note:
The available set range for the UV lamp is between 0 and 30 (000 to 030). When set to 000, the UV lamp is not turned on.
Condensation will occur and/or temperature distribution may be affected due to the heat of the UV lamp when the setting of the lamp operation is longer than 5 minutes or if the outer door is opened repeatedly.

OPERATING INSTRUCTIONS

Key lock function

This unit is provided with a key lock function. When the key lock is ON, change of temperature or CO_2 density setting through the key pad is not available.

Note: The key lock is set in OFF mode at the factory.

Display	Mode	Function
LO	Key lock is OFF	Enable to change of temperature setting
L1	Key lock is ON	Disable to change of temperature setting

Procedure for key lock setting (change from key lock OFF to key lock ON)

	Description of operation	Key operated	Indication after operation
1		----	The current chamber temperature is displayed.
2	Press ▶▶ key for 5 seconds.	▶▶	LO is displayed in the temperature indicator. LO
3	Press ▲ key and scroll the figure to 1.	▲	When pressed, the figure of settable digit increases. L1
4	Press ENT key.	ENT	The key lock is set to ON. The current chamber temperature is displayed.

Note:

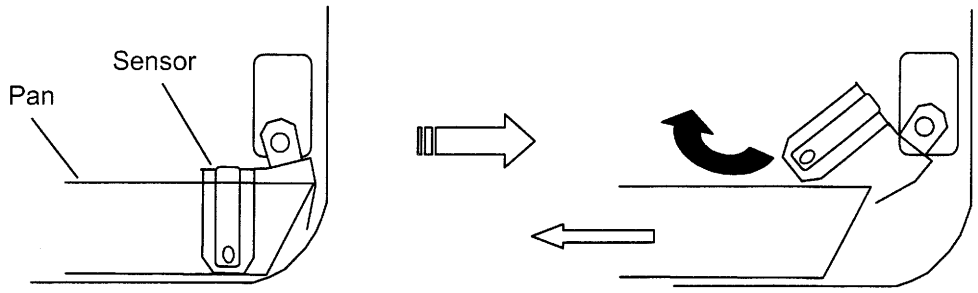
The key lock function is available for temperature and CO_2 density setting.

To cancel the key lock, set to L0 in the above procedure.

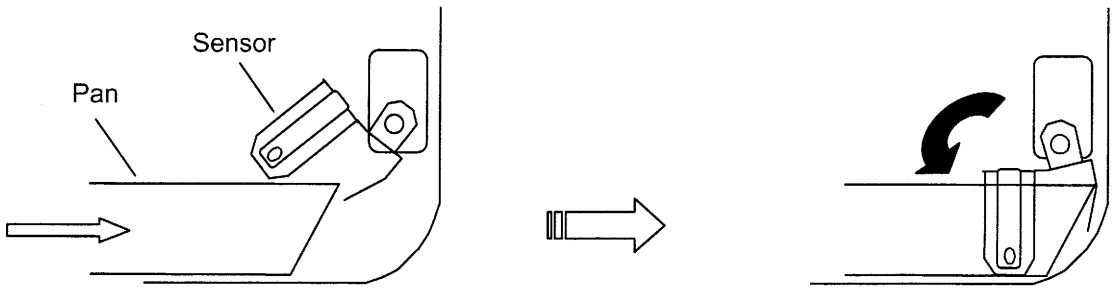
Water level sensor

This unit is provided with a water level sensor for the humidifying pan. The sensor is set in active position with respect to the installation of the humidifying pan. Take care not to damage the sensor at the time of removal or installation of the humidifying pan.

When the humidifying pan is removed (side view)



When the humidifying pan is installed (side view)



Note: At the installation, check the humidifying pan is located far depth and the sensor is down.

Note:

* Lift the sensor before installing the humidifying pan if the sensor is in lower position after maintenance.
* Use an alcohol for sterilization when cleaning the sensor, taking care not to stress the lead wire.
* The sensor detects the water level every 30 minutes. In addition, detection is executed after operation of the outer door. It takes several seconds to detect the water level. Therefore, the water level alarm lamp may flash a few times after the outer door is closed with the humidifying pan filled sufficiently.

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ALARMS & SAFETY FUNCTIONS

This unit has the alarms and safety functions shown in table below, and also self diagnostic functions.

Alarms and safety functions

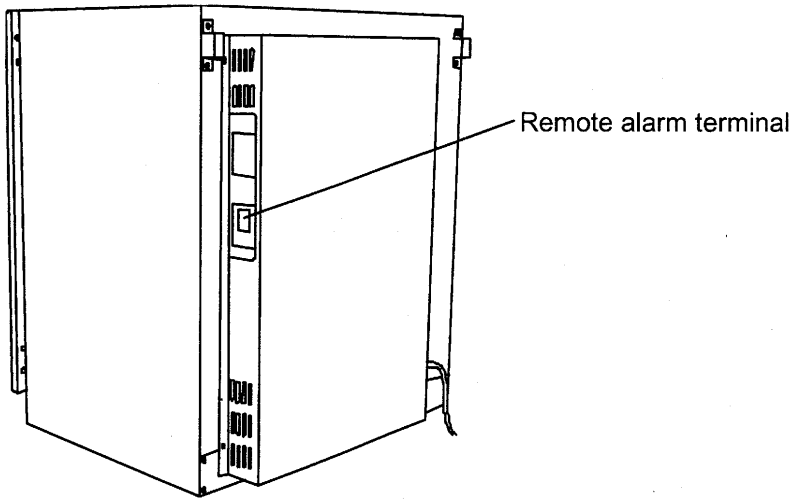
Alarm & Safety	Situation	Indication	Buzzer	Safety operation
Upper limit temperature alarm	If the chamber temperature exceeds the upper limit alarm temperature set value.	Over heat lamp lights. E12, E13, E14and chamber temperature are displayed alternately.	Continuous tone	Heater OFF
Automatic set temperature alarm	If the chamber temperature deviates from the set temperature by ±1°C or more.	All digits on the temperature indicator blink.	Intermittent tone with 15 minutes delay.	-----
Automatic set CO_2 density alarm	If the chamber CO_2 density deviates from the set value by ±1% or more.	All digits on the CO_2 density indicator blink.	Intermittent tone with 15 minutes delay.	-----
Auto-return	When there is no key pressing in each setting mode for 90 seconds.	Normal display mode.	-----	The setting mode is canceled.
Key lock	When the key lock is "ON".	-----	-----	The setting is disabled.
Automatic calibration function	Normally, the zero point of the CO_2 sensor is calibrated every 4 hours (or very 10 minutes for the first hour after switch ON), using the atmosphere as the gas to be calibrated.	The decimal point (period) on the CO_2 density indicator blinks.	-----	-----
CO_2 gas cylinder empty	If the CO_2 density does not increase when the gas valve is opened.	E01 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	-----
Gas line switching	When the gas supply line is switched. (only when MCO-20GC is installed)	E01 is displayed alternately with the temperature on the temperature indicator. Gas supply line indicator blinks.	Intermittent tone	Gas supply line is altered.
Chamber temperature sensor abnormality	If the temperature sensor is disconnected.	E05 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Heater OFF
	If the temperature sensor is short circuited.	E06 is displayed alternately with the temperature on the temperature indicator.		
Sensor box temperature sensor abnormality	If the sensor box temperature sensor is disconnected.	E07 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO_2 valve close.
	If the sensor box temperature sensor is short circuited.	E08 is displayed alternately with the temperature on the temperature indicator.		
Ambient temperature sensor abnormality	If the ambient temperature sensor is disconnected.	E9 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	-----
	If the ambient temperature sensor is short circuited.	E10 is displayed alternately with the temperature on the temperature indicator.		
CO_2 sensor abnormality	If the output voltage of the CO_2 sensor is abnormal.	E11 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO_2 valve close.
Main heater abnormality	If the upper limit alarm temperature alarm operates, or if the main heater is open circuit, or the main heater relay short circuit.	E12 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	-----
Bottom heater abnormality	If the bottom heater goes open circuit, or the bottom heater relay short circuit.	E13 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	-----
Door heater abnormality	If the door heater goes open circuit, or the door heater relay short circuit.	E14 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	
Sensor box heater abnormality	If the sensor box heater goes open circuit, or the sensor box relay short circuit.	E15 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	-----
Disconnection of sensor for each heater	If the relay of main heater, bottom heater or sensor box heater goes open circuit.	E16 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	-----
Air pump (for sample air or auto-zero) failure	If the air pump (sampling or auto zero) does not operate, or if there is something wrong in the gas piping.	E17 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO_2 valve close.
Low humidifying water	If the water in the pan is about 1 liter.	RH PAN lamp blinks.	-----	-----
Recommendation of new UV lamp	The accumulated ON time is over about 1,000.	UV indicator blinks when UV lamp is OFF.	-----	-----

* The remote alarm is silenced by pressing the buzzer stop key (BUZZER) as the remote alarm is operated in conjunction with the buzzer.
* The upper limit temperature alarm cannot be silenced with the BUZZER key.
* E01 is cleared automatically when the gas is connected correctly and the buzzer is silenced with the BUZZER key. If one of E05 to E17 (except for E12, E13, and E14) is displayed, consult with a Sanyo sales representative or agent.

ALARMS & SAFETY FUNCTIONS

Remote alarm terminal

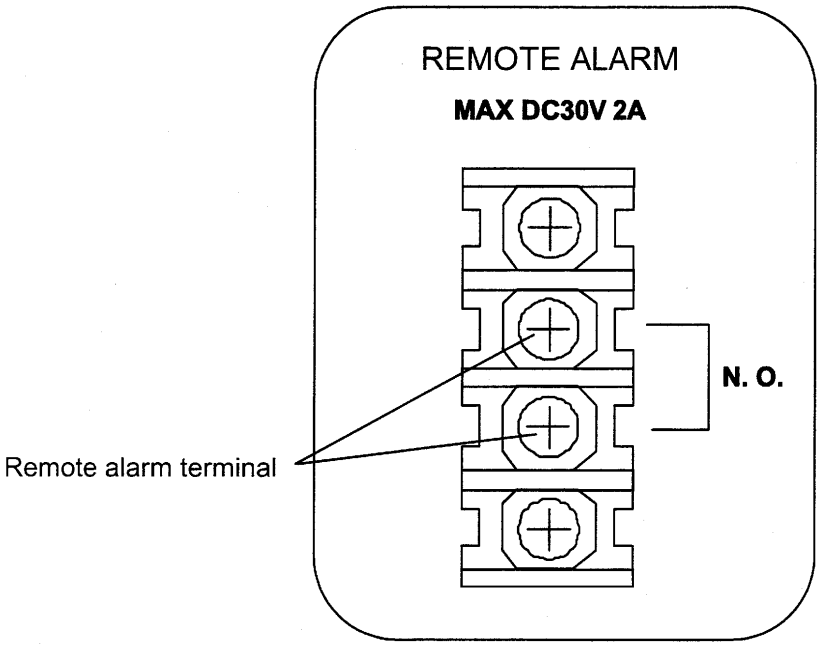
The remote alarm terminal and remote recorder terminals are located at the rear right side.



The remote alarm terminal is a contact output.

Normal	:	OPEN
Abnormal	:	CLOSE
Contact capacity	:	DC 30V, 2A, no voltage contact

When the power switch is OFF or the power failure condition, the contact output is CLOSE.



ROUTINE MAINTENANCE

⚠WARNING

Always disconnect the power supply to the unit prior to any repair or maintenance of the unit in order to prevent electric shock or injury.

Ensure you do not inhale or consume medication or aerosols from around the unit at the time of maintenance. These may be harmful to your health.

⚠CAUTION

Always put on dry gloves to protect hands at the time of maintenance. Failure to use gloves may result in cuts or abrasions from any sharp edges or corners.

Sterilizing of chamber and attachments

When the chamber of the unit is contaminated, the chamber and internal attachments should be cleaned and sterilized as follows.

Note:

Take care not to damage the UV lamp or water level sensor at the time of removal or replacement of attachments.

Do not clean the inside of the unit with a solution of disodium chlorate or other halogen-based solution because this may cause rust.

1. Take out all trays and the humidifying pan from the chamber.

2. Remove top panel, side support (right and left side), tray supports, and the fan as shown in the figures on page 23 and 24.

3. Clean all the attachments with neutral detergent and then rinse away the detergent with distilled water.

4. Wipe the attachments with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

5. Wipe the inside wall of the with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

6. Replace all attachments in the chamber.

Note:

Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

7. Fill the humidifying pan with sterile distilled water.

ROUTINE MAINTENANCE

Removal of attachments

Note:
Take care not to damage the UV lamp or water level sensor at the time of removal or replacement of attachments.

1. Close the valve of the gas cylinder and turn off the power.

2. Open the outer door. Remove 2 pins fixing the inner hinge and remove the inner door.

3. Pull out the all trays. See Fig. 1

4. Remove all tray supports on the right and left side by lifting up the front side. See Fig. 2.

5. By lifting up the humidifying pan cover, unhook it at the rear and remove the cover as shown in Fig. 3.

6. Take out the humidifying pan. See Fig. 4

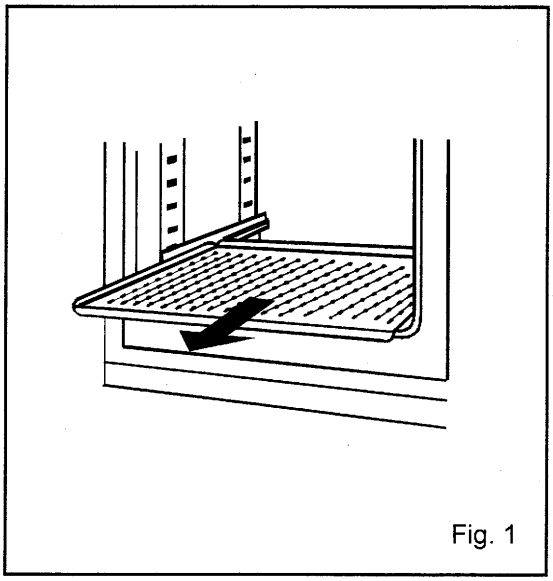


Fig. 1

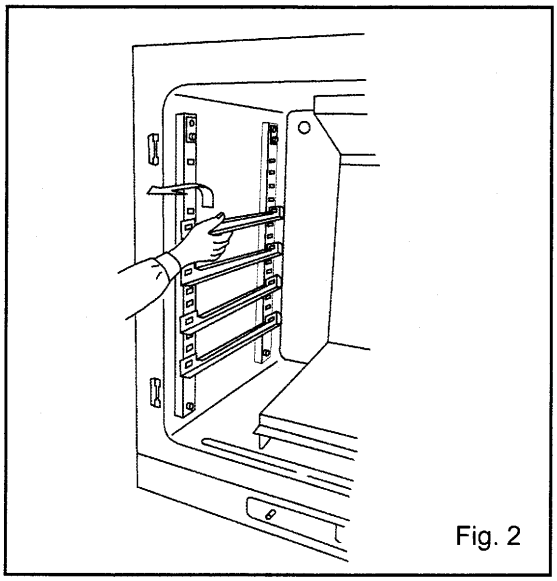


Fig. 2

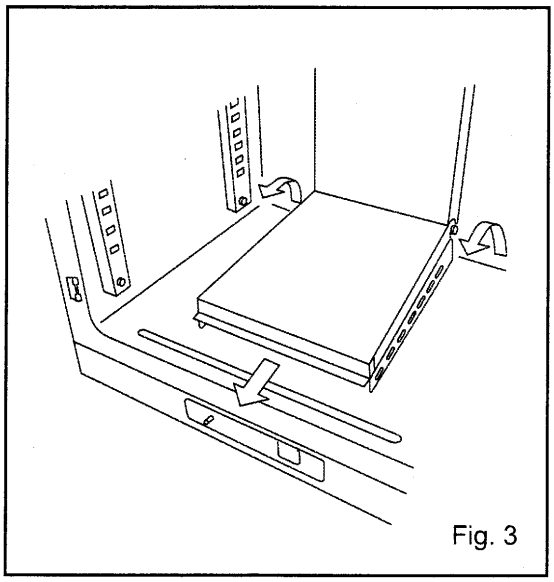


Fig. 3

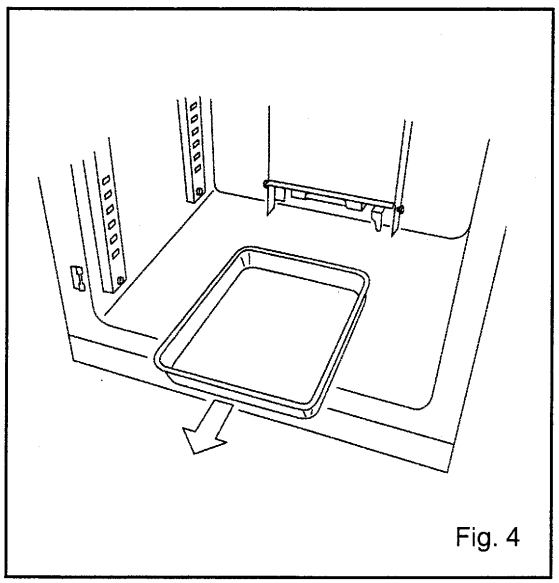


Fig. 4

ROUTINE MAINTENANCE

7. After removing 2 screws fixing the top duct, take out the top duct by removing pin. See Fig. 5.

8. To remove the rear duct, lift it up as shown in Fig. 6.

9. To removing the circulating fan, pull out the spring and then pull the fan. See Fig. 7.

10. Loosen and remove the screw fixing the clamp and remove the clamp. See Fig. 8 and Fig. 9.

11. By lifting the side support, take it off from the hooks. See Fig. 10.

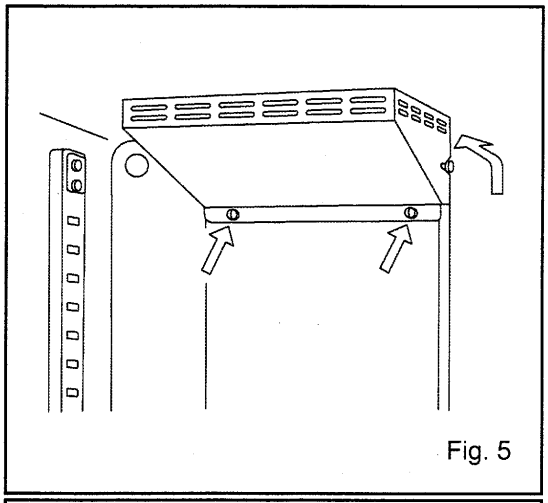


Fig. 5

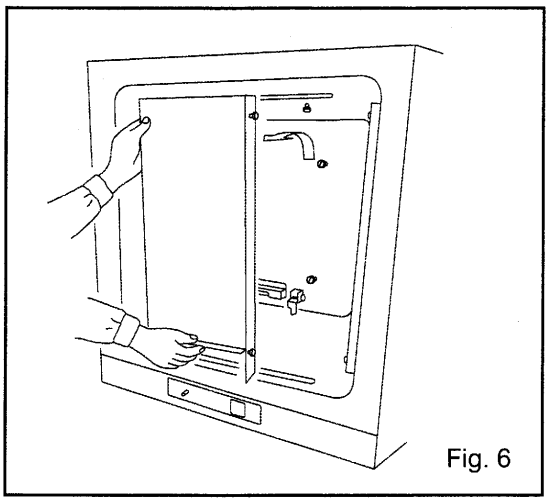


Fig. 6

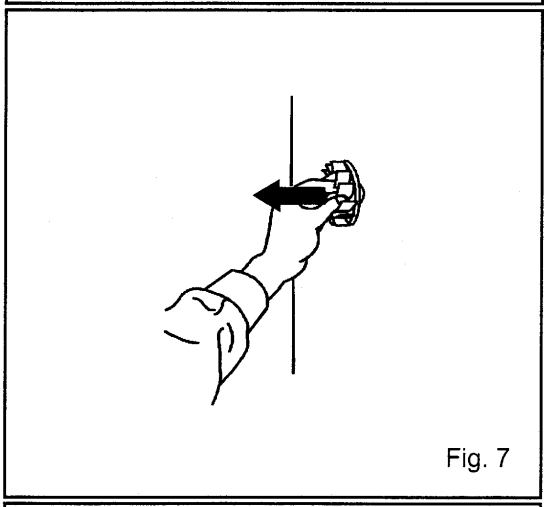


Fig. 7

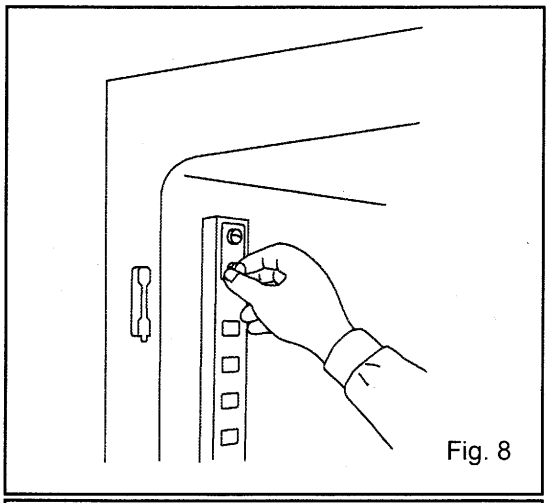


Fig. 8

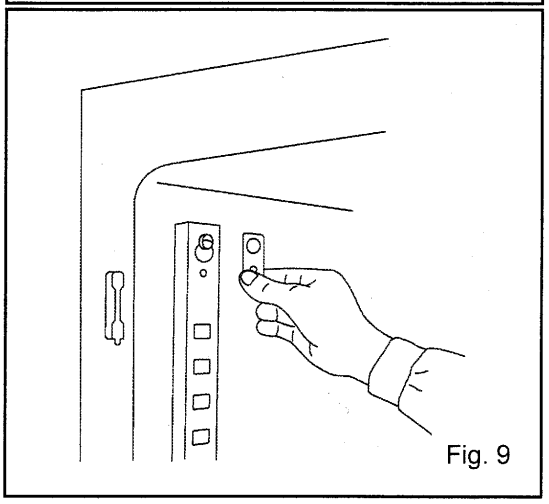


Fig. 9

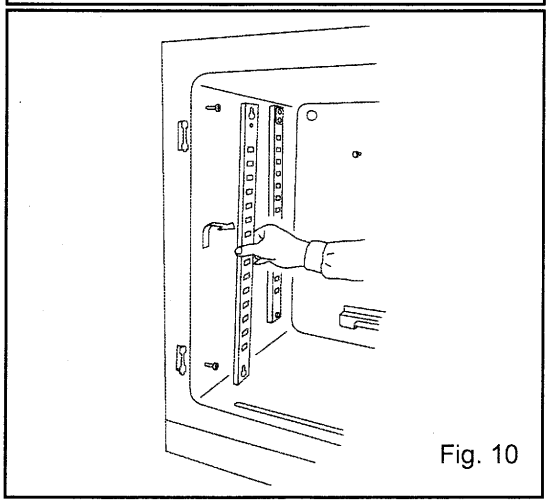


Fig. 10

12. Replace all attachments in the chamber with the reversed order mentioned above.

Note:

Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

ROUTINE MAINTENANCE

Filling the humidifying pan

Replace the water in the humidifying pan when the water level lamp lights. To fill the humidifying pan, do the following:

1. Lift the front side of the humidifying pan cover as shown in Fig. 1.

2. Pull out the humidifying pan toward you. See Fig. 2.

3. Dispose of the water in the pan and wash it with neutral detergent. Then rinse the pan with distilled water sufficiently. Finally, wipe the pan with a soft cloth and alcohol for disinfection.

4. Wipe off the bottom of the chamber completely.

5. Place the pan under the pan cover and pour the sterile distilled water (about 5 liter) into it. See Fig. 3. Make sure that the water is pre-heated at 37°C.

6. Push the pan in to its correct position and replace the cover over the pan.

7. Check that the water level lamp on the control panel is off.

Note:
The sterile water filled in the humidifying pan should be pre-heated at 37°C. Cold water lowers the chamber temperature.

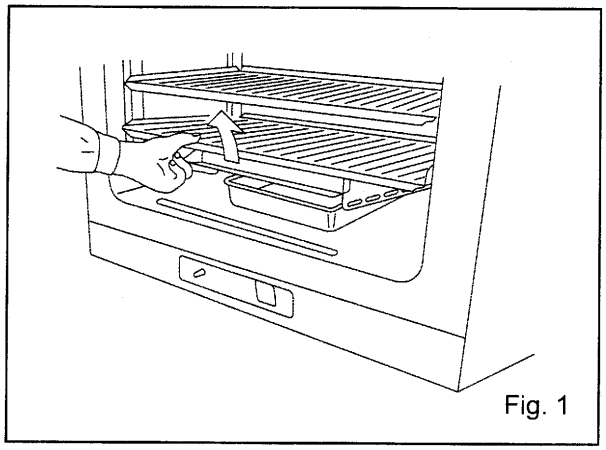


Fig. 1

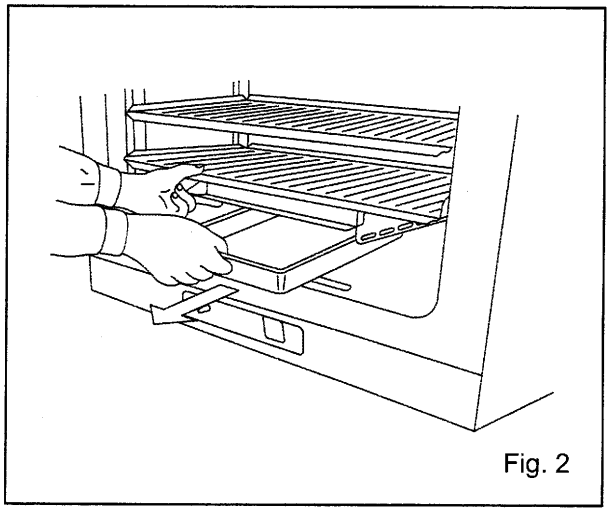


Fig. 2

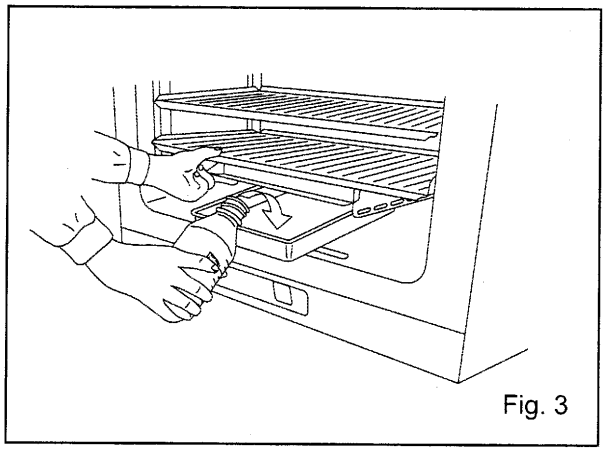


Fig. 3

CALIBRATION

Temperature calibration

1. Press the CAL key for approximately 5 seconds.
2. The third digit of the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Set the present correct temperature with the ▶▶ key and ▲key, then press the ENT key.
4. The unit automatically reverts to the display mode.

[Example]
If the displayed chamber temperature is 37.0°C (set value) and the actual temperature is 36.8°C.
1. Press the CAL key for about 5 seconds.
2. The "3" on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Adjust the set value to the actual value of 36.8°C with the ▶▶ key and ▲key, then press ENT key.
4. The unit automatically reverts to the display mode.

Note:
It is important to accurately measure the temperature inside the unit when performing temperature calibration. Particularly, the temperature gauge used must have an accuracy of 0.5 Class or better. The temperature must be measured at several points.
The temperature setting must not change by more than ±1.0°C during calibration. If it exceeds this, an error tone is emitted, the input data is ignored, and the unit reverts to the display mode. Consequently, if it is necessary to change the temperature by more than 1.0°C, perform calibration in several stages over a period of time.

CO_2 calibration

Span setting
Span setting should be done under stable condition of temperature, humidity, and CO_2 density.
1. Press the CAL key for about 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO_2 density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO_2 density with the ▶▶ key and ▲key, then press the ENT key.
6. The unit automatically reverts to the display mode.

Note:
This calibration is available when the setting of CO_2 density is 2% or more.

[Example]
For an internal CO_2 density of 5.0% (setting) and a measured value of 4.5%.
1. Press the CAL key for about 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO_2 density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO_2 density (4.5%) with the ▶▶ key and ▲key, then press the ENT key.
6. The unit automatically reverts to the display mode.

TROUBLE SHOOTING

If the unit malfunctions, check out the following before calling for service.

The unit does not operate at all

1. Is the unit plugged correctly into a power outlet?
2. Is the circuit breaker at the power source active?
3. Has a power failure occurred?

The key operation is disabled

1. Is the key lock function set in OFF mode?

If the alarm function operates

If the alarm function and the buzzer operates, check the cause using the following procedure.
[At the beginning of operation]

1. Is the chamber temperature equal to the set value?
2. Is the chamber CO_2 density equal to the set value?
   a. Is the secondary pressure of the pressure regulator equal to the set value (0.03MpaG, 0.3kgf/cm^{2}G, 4.3psiG)?
   b. Is the tube connected securely between the pressure regulator and the unit?

[During operation]

1. Is the upper limit alarm temperature set at least 1°C higher than the set chamber temperature?
2. Was the set temperature value changed, or the door left open for a long period? Was a low temperature load placed inside the unit? In this case, if the unit is left as it is, the alarm will eventually clear itself.
3. Has the gas tube slipped off?
4. Was the set value of the gas density changed?
5. Is the gas cylinder empty? Check the primary pressure of the CO_2 cylinder once a week.

If the chamber temperature is not equal to the set temperature

1. Is the temperature in the vicinity too high? The ambient temperature must always be at least 5°C less than the set temperature.
2. Was the outer door closed while the inner door was left open?

If the gas density does not coincide with the set value

1. Is the secondary pressure set to 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG)?
2. Is the gas tube clogged or chinked?

If the chamber humidity does not rise

1. Is the humidifying pan filled with sterile distilled water? (Always use sterile distilled water.)
2. Is the humidifying pan cover installed correctly?

If the CO_2 consumption is too much

1. Is the door opened frequently?
2. Is there any gas leakage at the connection or pin hole on the tube? It is recommended to replace the tube once a year.
3. Is the gasket of the inner door completely sealed?
4. Is the access port at the upper left corner opened?

If normal cultivation cannot be done and chamber gas density is suspect

1. Is the environment around the unit normal? Is the source of the contaminated gas nearby?
2. Is the unit installed in an enclosed space?

If it takes much time to recover the gas density

1. HEPA filter is provided in the gas piping. If it takes much time to recover the gas density even though the gas pressure is normal, it may be that dust on the HEPA filter prevents the gas flow. Consult the Sanyo dealer or agent.

ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe under the following conditions:

1. Indoor use;

2. Altitude up to 2000 m;

3. Ambient temperature 5°C to 35°C

4. Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C;

5. Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage;

6. Other supply voltage fluctuations as stated by the manufacturer;

7. Transient overvoltages according to Installation Categories (Overvoltage Categories) II; For mains supply the minimum and normal category is II;

8. Pollution degree 2 in accordance with IEC 664.

DISPOSAL OF UNIT

⚠WARNING

If the unit is to be stored unused in an unsupervised area for an extended period **ensure that children do not have access and doors cannot be closed completely.**

The disposal of the unit should be undertaken by appropriate personnel. Always remove doors to prevent accidents such as suffocation.

STACKED MODULE

This unit can be stacked by using the stacking kit. Following shows the procedure for stacking the unit. Consult with a Sanyo representative or agent prior to stacking procedure as such work involves dangers.

⚠WARNING

Select a level and sturdy floor having enough strength for installation of stacked module.
Never stack 3 or more units.
Take care not to drop or tip over the unit when stacking as this can cause injury or damage of the unit.

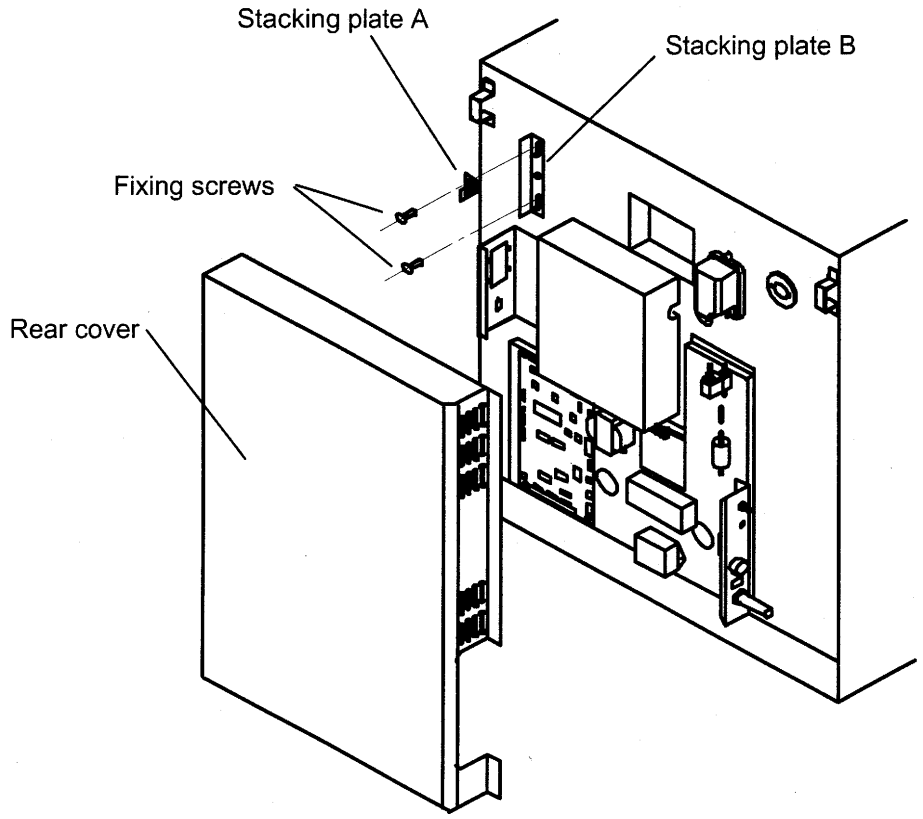
1. Turn off the power switch and disconnect a plug of each unit.

2. The stacking plate A and B are attached on the back of each unit. To prepare the stacking plate A and B, remove the rear cover by unscrewing 6 screws on the rear cover. See the figure below.

3. Take out the stacking plate A and B by loosening 2 fixing screws on each unit.

4. Replace the rear cover and fix it with 6 screws.

5. Check that the lower unit is level.



STACKED MODULE

6. Apply the protective sticker enclosed with the unit at each corner on the top of the lower unit to avoid scratches or damage.

7. Fix the stacking plate A at 2 locations on the top front of the lower unit by using 2 screws removed in step 3.

8. Remove the front panel on the upper unit by unscrewing the 4 fixing screws and then disconnect the wires and gas tube.

9. Stack the unit so that both units can be aligned straight. Also check the upper unit is level. If it is not level, keep the unit even by adjusting the leveling legs.

10. Secure the upper unit with the stacking plate A and 2 screws removed in step 3.

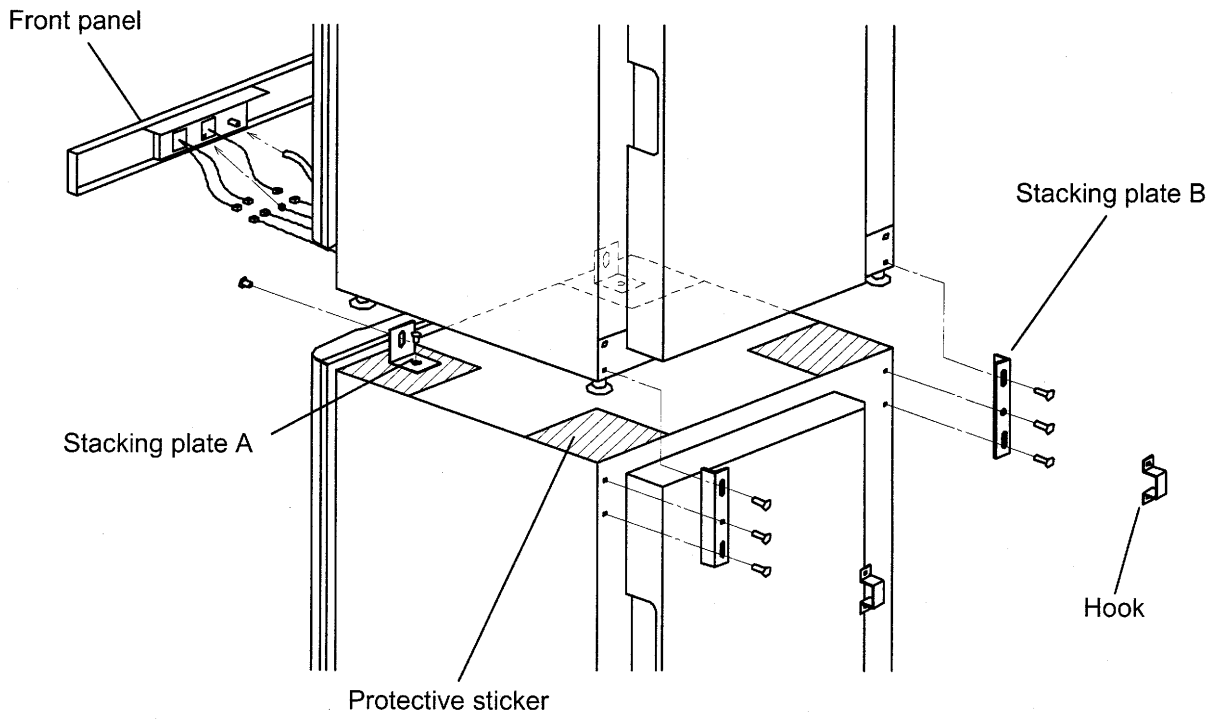
11. Remove 2 hooks on the rear side of the lower unit by unscrewing each 2 fixing screws.

12. Remove 1 screw on the bottom right and left on the rear side of the upper unit.

13. Fix the stacking plate B at the right and left on the rear of the lower and upper unit with 3 screws removed in step 11 and 12.

14. Replace the front panel on the upper unit after connecting the wires and gas tube.

15. Fix the stacked unit to the wall with 2 hooks on the rear of the upper unit and rope or chain.



SPECIFICATIONS

Name	CO_2 Incubator
Model	MCO-20AIC
External dimensions	W770 x D708 x H900 (mm)
Internal dimensions	W620 x D523x H665 (mm)
Effective capacity	195 L
Exterior	Polyester finish baked on zinc galvanized steel
Interior	Stainless steel containing copper
Outer door	PMMA/PVC
Inner door	Tempered glass
Tray	5 trays made of stainless steel containing copper W580 x D450 x H12 (mm), Maximum load; 5 kg/tray
Access port	Inner diameter; 30 mm, On the back side
Insulation	Rigid polyurethane foamed-in place (CFC-FREE)
Heating system	DHA system (heater jacket + air jacket system)
Heater	395 W
Humidifying system	Natural evaporation with humidifying pan
Temperature controller	PID control
Temperature display	Digital display
CO_2 controller	ON-OFF control system
CO_2 density display	Digital display
Air circulation	Fan assisted
Air filter	0.3 μ m, Efficiency; 99.97%
UV lamp	4 W, Ozone free type
Water level sensor	Optical type
Alarm	Temperature alarm, CO_2 density alarm, Upper limit temperature alarm, Door alarm
Remote alarm contact	Allowable contact capacity: DC 30 V, 2 A
CO_2 connecting inlet	4 to 6 mm diameter tube
CO_2 gas pressure	0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG)
Accessories	5 trays, 5 sets of tray support, 1 gas tube, 1 humidifying pan, Stacking plate A and B (fixed on rear of the unit), 2 tube bands
Weight	106 kg
Optional accessory	CO_2 pressure regulator (MCO-100L), Roller base (MCO-20RB) Automatic gas switcher (MCO-20GC) Extra tray (MCO-58ST) including 2 tray supports

Note: Design or specifications is subject to change without notice.

PERFORMANCE

Usable environment condition	Temperature; +5°C to 35°C, Humidity; equal or less than 80% R.H.	
Temperature control range	Ambient temperature +5°C to 50°C (ambient temperature; 5°C to 35°C)	
Temperature distribution	± 0.25°C* (ambient temperature; 25°C, setting; 37°C, 5%, no load)	
Temperature variation	± 0.1°C (ambient temperature; 25°C, setting; 37°C, 5%, no load)	
CO_2 control range	0 to 20%	
CO_2 variation	± 0.15% (ambient temperature; 25°C, setting; 37°C, 5%, no load)	
Chamber humidity	95 ± 5% R.H.	
Maximum power consumption	380 W	
Total maximum current	110 to 120 V	220 to 240 V
	3.7 A	1.9 A
Maximum heat emission	1370 kJ/h	
Noise level	30 dB (A scale)	

Note: The unit with CE mark complies with EC directives 89/336/EEC, 93/68/EEC and 73/23/EEC.

* It is based on our measuring method.

⚠ CAUTION

Please fill in this form before servicing.
Hand over this form to the service engineer to keep for his and your safety.

Safety check sheet

1. Refrigerator contents : ☐Yes ☐No
   Risk of infection: ☐Yes ☐No
   Risk of toxicity: ☐Yes ☐No
   Risk from radioactive sources: ☐Yes ☐No

   (List all potentially hazardous materials that have been stored in this unit.)
   Notes :

2. Contamination of the unit
   Unit interior ☐Yes ☐No
   No contamination ☐Yes ☐No
   Decontaminated ☐Yes ☐No
   Contaminated ☐Yes ☐No
   Others:

3. Instructions for safe repair/maintenance of the unit
   a) The unit is safe to work on ☐Yes ☐No
   b) There is some danger (see below) ☐Yes ☐No
   Procedure to be adhered to in order to reduce safety risk indicated in b) below.

Date :
Signature :
Address, Division :
Telephone :

Product name :	Model :	Serial number :	Date of Installation :
CO_2 incubator	MCO-20AIC		

Please decontaminate the unit yourself before calling the service engineer.

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Recycled paper

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